MACHINE DESIGN

EDITOR
L. E. Jermy

ASSOCIATE EDITORS
Allen F. Clark
Harold B. Veith
F. H. Burgess

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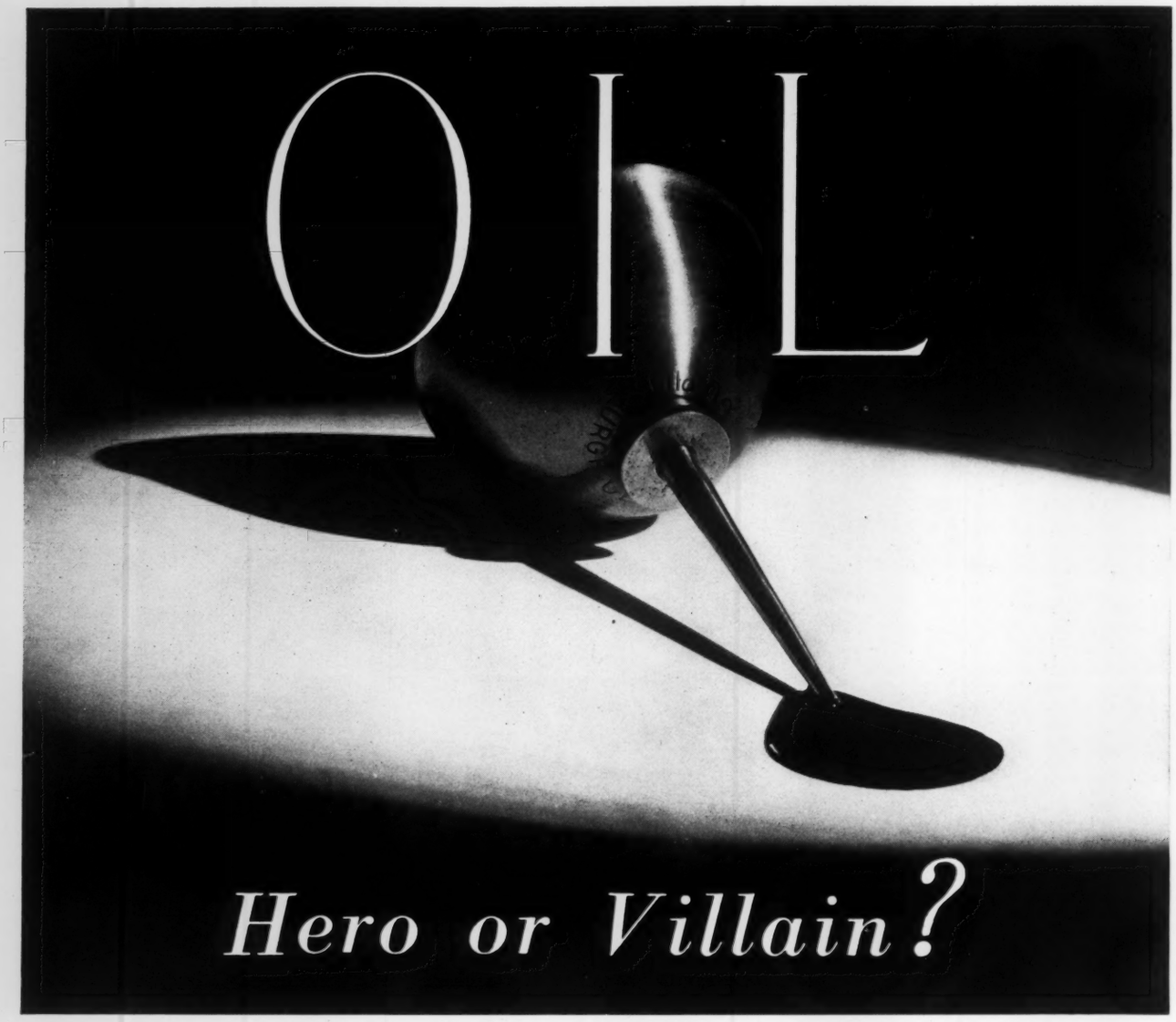

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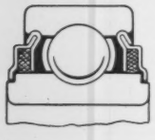
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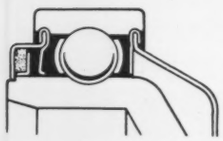
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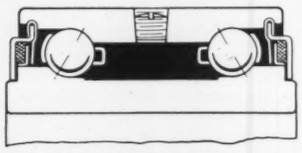
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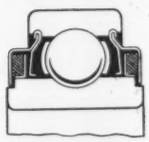
N-D-SEAL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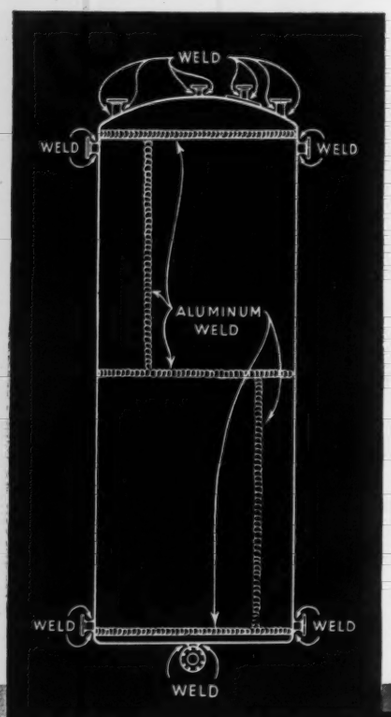
Design for OXWELDING *and specify the Best*

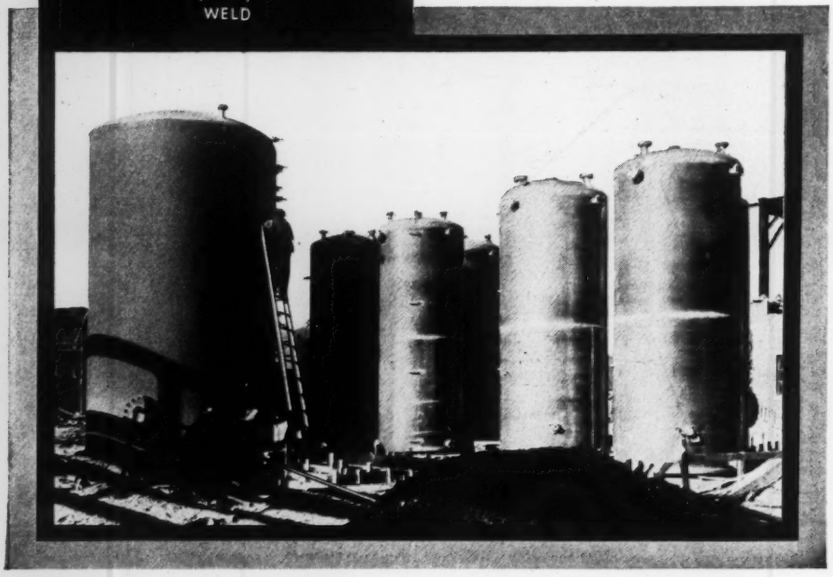


A LONG successful record of chemical equipment designed for oxwelding and built with the advice and assistance of Linde Process Service is reflected in the following quotation from a chemical firm's specifications for six large aluminum tanks:

"Welding is to be by the oxy-acetylene process using Oxweld Aluminum Welding Rod and Oxweld Aluminum Flux. Special care is to be taken as the tank is to contain acid. The approval of each welder must be obtained through a qualification test from The Linde Air Products Company before welding is done."

Before planning equipment this firm has regularly obtained from Linde the latest data on performing the specific welding job and specifications have been drawn to require techniques, materials, and testing methods proved in the vast experience of Linde Process Service. In this way the soundest, strongest, most economical fabrication is assured.

You can have this in your equipment too, by simply taking advantage of Linde Process Service. The nearest Linde Sales Office will be glad to explain this service to you. Phone or write now.



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Continuing previous records for service, Linde advised on the correct type of oxwelded joints and the welding materials for building these 3000-gal. aluminum tanks. Every seam was leakproof under hydrostatic test. All welders were rigidly qualified by Linde.

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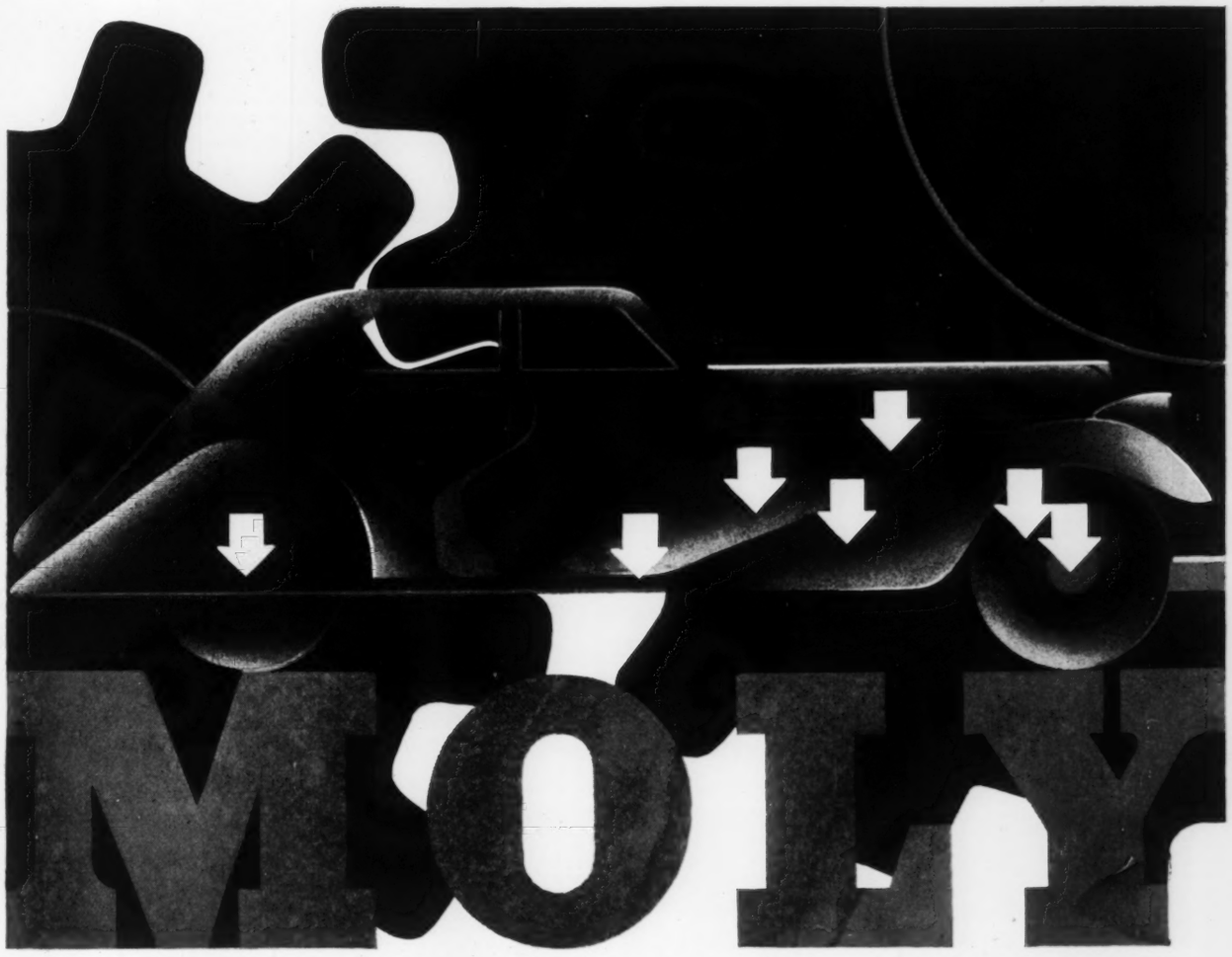

puts vitality into carburizing steels

REAR-END and transmission gears, pinions, cam and crankshafts, spindles, wrist and steering-knuckle pins . . . more is demanded of them than ever before in the history of the automotive industry. Many of the steels on the market are suitable for the carburizing required for such parts facing the stress of high speed, shocks and the fatigue of long periods of continuous heat and action.

But today there must also be considered the important matter of *facility* in the construction of such parts.

SAE 4615 (Nickel Molybdenum) is widely proving itself the most economical and otherwise most desirable steel for carburized gears of all types and other parts requiring the same properties. Good machinability—tough and refined case and core when quenched from the carburizing pot—and small and measurable distortion during heat treating . . . are some of the properties which have led to almost national standardization on this steel for automotive carburized parts.

There is also, of course, the 3.5% Nickel Molybdenum steel for similar, but heavier-duty applications.

Follow the rapid strides being made by "Moly" in most every diversification of the steel and iron industry — by asking to be put on the mailing list of our periodical house organ, "*The Moly Matrix.*" Write also for these interesting books: "*Molybdenum in* 1934" and "*Molybdenum in Cast Iron* — 1934 *Supplement.*" And, if you've an alloy problem that's difficult to solve, be free to enlist the help of our metallurgists and Detroit experimental laboratory. Climax Molybdenum Company, 500 Fifth Ave., New York City. (In Canada: Railway & Power Engineering Corp., Ltd.)

CLIMAX Mo-lyb-den-um

CALENDAR OF MEETINGS AND EXPOSITIONS

May 14-15—

American Gear Manufacturers association.

The program for the annual meeting to be held at the Penn-Lincoln hotel, Wilkinsburg, Pa., will include a paper on "Methods for Checking Gears," by D. T. Hamilton, Fellows Gear Shaper Co., in collaboration with Robert Beardsley, Jones & Lamson Co. S. O. Bjornberg, Illinois Tool Works, has been engaged to discuss "Inspection Methods That Give a New Conception of Gear Accuracy," and Jordan Korp., Leeds & Northrup Co., is scheduled to cover "Heat Treatment of Miscellaneous Gearing," in his paper. One of General Electric's prominent engineers will lecture on "Science of Seeing," and also included in the meeting will be an address by J. H. Van Deventer, Editor of Iron Age, on "Where Do We Go From Here?" British standards with particular reference to worm gears will be discussed by Prof. Earle Buckingham, and F. E. McMullen, Gleason Works, will discuss British standards with reference to bevel and spiral bevel gears. J. C. McQuiston, Penn-Lincoln hotel, is manager-secretary of the association.

May 20-23—

National Association of Purchasing Agents

Annual meeting and information show to be held at New York. G. A. Renard, 11 Park place, New York, is secretary of the association.

May 20-May 25—

National Society of Air Conditioning Engineers.

First national air conditioning show will be held in Chicago in conjunction with the annual convention of the National Society of Air Conditioning Engineers. The exposition will include a display of large and small air conditioning units equipment and accessories. J. C. Hines, air conditioning engineer of the R. B. Hayward Co., Chicago, is head of the committee in charge of the exposition which will be held at the Merchandise Mart.

May 22-24—

American Society of Refrigerating Engineers.

Spring meeting to be held at Hotel Statler, Detroit. David L. Fiske, 37 West Thirty-ninth street, New York, is secretary of the society.

May 23—

American Iron and Steel Institute.

Annual spring meeting to be held at New York. H. H. Cook, 1829 Empire State building, New York, is secretary of the institute.

June 3-7—

National Confectioners' Association of the United States, Inc.

Exposition of equipment and annual meeting to be held at the Palmer House, Chicago. The exposition is being managed by Roberts Everett Associates, 232 Madison avenue, New York.

June 16-20—

Society of Automotive Engineers.

Annual summer meeting to be held at White Sulphur Springs, W. Va. John A. C. Warner, 29 West Thirty-ninth street, New York, is secretary of the society.

June 17-19—

American Society of Heating and Ventilating Engineers.

Semiannual meeting to be held at Royal York hotel, Toronto, Ontario, Canada. A. V. Hutchinson, 51 Madison avenue, New York, is secretary.

June 17-20—

American Society of Agricultural Engineers.

Twenty-ninth annual meeting of the society to be held at the University of Georgia, Athens, Ga., will include technical papers on rural electrification, and on farm power and machinery. Raymond Olney, St. Joseph, Mich., is secretary of the society.

June 18-19—

American Society of Mechanical Engineers.

Applied Mechanics division will hold its national meeting at the University of Michigan, Ann Arbor, Mich. Dr. S. Timoshenko of the university is in charge of the program.

June 19-21—

American Society of Mechanical Engineers.

Annual summer meeting to be held at Hotel Gibson Cincinnati, O. Clarence E. Davies, 29 West Thirty-ninth street, New York, is secretary of the society.

June 24-28—

American Institute of Electrical Engineers.

Semiannual meeting to be held at Cornell University, Ithaca, N. Y. H. H. Henline, 33 West Thirty-ninth street, New York, is secretary of the institute.

June 24-28—

American Society for Testing Materials

Thirty-eighth annual meeting and exhibit of testing apparatus and related equipment will be held at Book-Cadillac hotel, Detroit. C. L. Warwick, 260 South Broad street, Philadelphia, is secretary of the society.

MACHINE DESIGN
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Clad Metals, Roller Clutch Used in Bottler

By A. J. Lippold
Cherry-Burrell Corp.

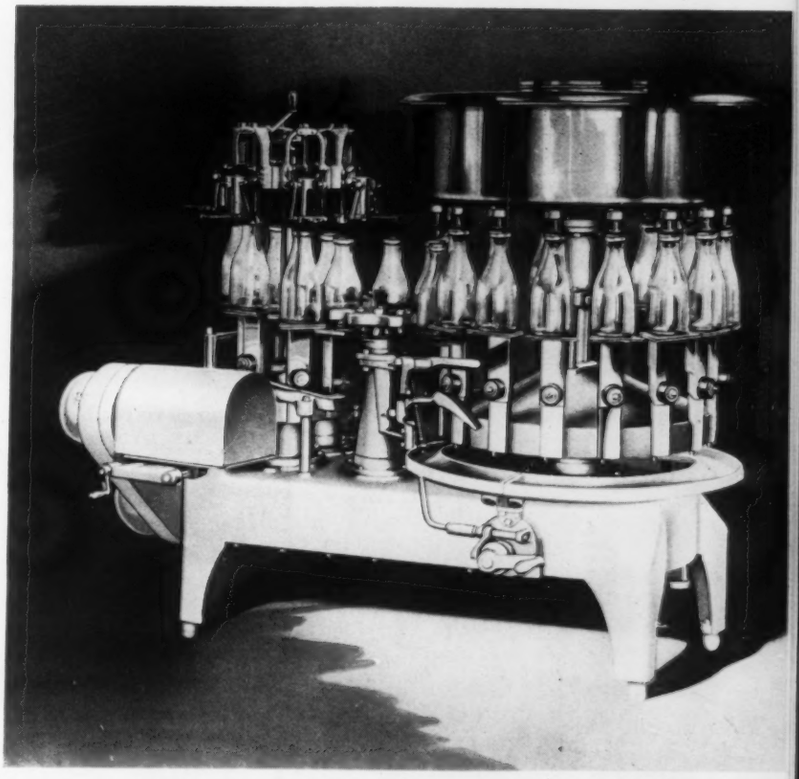


Fig. 1—Bottle filling machine employs materials and finishes to resist corrosion and incorporates infinitely variable speed

SATISFACTION is a dangerous thing! Dangerous because it might easily lead to smugness. And smugness blinds us to the fact that even though the mechanisms developed by ourselves and by others do an excellent job, there may be better or more economical means of accomplishing the same task.

An excellent example of where satisfaction might have been allowed to eradicate the desire for improvement is in the mechanisms employed for the filling of bottles. One of the earliest mechanical devices known to man, the inclined plane, has long served in this capacity. Lifting levers operating over cams and other means for bringing a bottle to the filling valve and holding it there have efficiently performed their task. These are but a few of the many former developments in this field.

But now there is something new in bottle filling. Cherry-Burrell Corp., Chicago, has devised flexible cams for raising the bottles which allow for possible inaccuracies in bottle heights, and have adapted a variation of the roller clutch principle to the job of holding the bottles in place during filling. Further refinements in this milk bottle filler and capper, *Fig.* 1, include the provision of infinitely variable speed so that the machine will accommodate itself exactly to the flow of liquid and bottles to it; the development of a driving means which makes use of only six revolving parts, times the parts accurately, and eliminates many parts used in previous models; and the incorporation of a safety release clutch pulley which insures safety

Fig. 2—Hinged cam permits automatic adjustment of lifter elevation to accommodate variations in heights of bottles

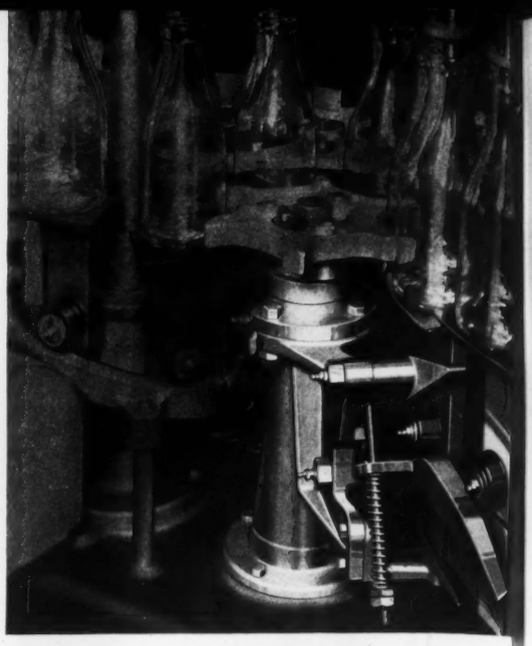


Fig. 3—The lowering cam is low enough to catch any lifters that might be down already, and in addition a spring yields to give smooth action

for both machine and product.

In the filling of the bottles, the provision made to accommodate both short and tall bottles comprises the lifting cam shown in *Fig.* 2. This cam is not a solid fixed track. Hinged at its lower end, its upper end is held up by a single spring when the roller raises the lifter and bottle. When the bottle opens the cam in the milk supply valve, the spring in the cam yields and the lifter roller passes off the cam. One heavy spring, located where it can easily be inspected, serves all of the lifters. No adjustments are required for any size of bottles and the yielding spring while allowing for differences in height opens the supply valve fully.

Similar provision for bottle variations are provided in the lowering cam, *Fig.* 3, which forms a track for the rollers to roll down after the holding mechanism in the lifters has been released. The outer end of this part extends low enough to catch any rollers that might be down. The long spring then yields so that the cam will receive the roller smoothly. A separate guide, above the cam, makes certain that each roller is brought down to the proper level at this point.

With this replacement of usual roller lifters, spring supported lifters and toggle raised lifters with the spring inside, it became necessary to devise means for holding the bottles in place during the filling operation. This holding is accomplished by a unique Rollock mechanism which applies the principle of the much-discussed roller clutch to a practical industrial job.

Lifter Slides Over Guide

These lifters, shown in *Fig.* 4, are mounted on a cone-shaped tinned iron casting which is part of the revolving table. They comprise a flat top for carrying the bottle as part of a rectangular tube which slides down over the lifter guide. This top and the tube are of 18-8 stainless clad steel. At the bottom end of the tube is attached a hardened roller which projects outwardly to contact the lifter cams.

It is the parts of the lifter guide, shown in cross section in *Fig.* 4, that accomplish the unique holding action. Working on the principle of a wedge, the roller in this guide presses against a tapered cam in the guide and against the inside wall of the lifter tube. The angle of the cam is twelve degrees, and the cam is of 18-8 stainless steel, hardened. Pressure is instantly relieved when the lifter tube moves upward, but locks in the downward direction as soon as the lifter comes to rest.

Rod Releases Lock Roller

When filling has been completed and the bottle is about to be lowered, a cam below the lowering cam in *Fig.* 3, raises a small round release rod which passes up through a vertical hole in the guide and is attached by a simple clip to the roller of the clutch. This release permits the lifters to drop by gravity, being limited by the lowering cam. Should it be desirable to remove a bottle during the time when it ordinarily would be filling, this release rod may be actuated by hand to lower the lifters. When the lifter drops, it rests on the top of the guide at just the height of the transfer table. Each guide has a screw in the top that may be set up or down in case of wear on the transfer table or wear on the top surface of the bottle lifter. In designing the locking mechanism a simple unit has been evolved which besides having all parts easily accessible performs the locking function in a positive manner, yet permits of release at any time should this be necessary.

In the capping mechanism which operates as a unit with the filler, the lifter guides are the same as in the filling mechanism except that the roller clutch and release rod are not required as the lifter rollers are supported by a cam throughout the cycle. Here again the lifting and lowering cams and guides are equipped with springs which permit them to yield to accommodate varying bottle heights. As in the rest of the machine, this mechanism employs cast iron, plated tinned or galvanized to resist

corrosion. Cadmium plating is widely used also in this service.

While this discussion has mentioned the ability of the machine to adjust for varying heights of bottles, it must not be assumed that adjustment is for varying sizes. Each size of bottle will vary in itself by as much as one-half inch, and it is this variance that is accommodated by the springs. To adjust for the various sizes, the tank

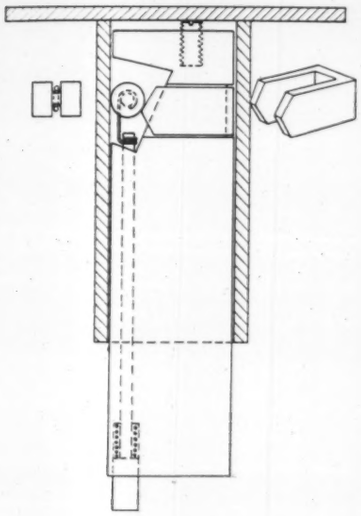


Fig. 4 — Overrunning clutch principle is adapted to lifters to hold table in place after it has been positioned by the lifting cam

and the capper are raised or lowered by use of the hand cranks shown at the right of the base in *Fig.* 1, and at the top of the capper, at left in the illustration.

Assembly Firmly Clamped

The hand crank for the tank is attached through gearing to the tubing in the center, which rides on the central motivating shaft. The small handle on the left engages the gearing when held down and disengages when released. The capper is adjusted by the hand crank at the top and when in proper position the assembly is clamped firmly in place by the hand screw on the side thereby removing all looseness required for adjustment as well as to take up all future wear. The clamping screw bears against a split bushing surrounding the shaft. One side of the bushing is bolted in the bore of the housing while the other side floats with it during vertical adjustments.

Other adjustments for size of bottles include the changing of the star wheels and bottle guides. The star wheels are designed so that to change them, all that is required is to lift one size off and set the other size on three pins projecting from the plate which gives them their rotation through action of a driving shaft. Ease of adjustment is also provided for in the guides which are changed by loosening a knurled nut and then lifting them off. These guides are a simple one-piece casting that is three guides in one—infeed, transfer and discharge—and are designed so that they may be used for either right or left hand machines. The transfer table is a flat sheet of heavy stainless-clad plate steel.

Infinitely Variable Speeds Provided

These adjustments for size of bottle also must include an adjustment for the speed of filling. In previous models, two-speed filling was provided for by change gears. While this method of obtaining varying speeds of filling was quite practical, it did not enable the machine to be adjusted precisely to that of co-operating machines. Such adjustment was highly desirable in order that there be no hold-up in the production line or no build-up of extra bottles that could not be taken away from the filler fast enough. Therefore, a variable speed motor pulley which may be adjusted while the machine is in operation was adopted. This motor pulley, shown in *Fig.* 5, also permits adjusting the speed for the product being processed, heavy cream, buttermilk and fluid milk.

From this motor pulley, a drive extends to a safety release clutch pulley which automatically protects the product and machine by giving positive mechanical release in case of an overload. As contrasted with former safety pulleys which depended on spring tensioned friction disks, the new pulley, *Fig.* 5, breaks the driving connection completely and will not drive again until reset. Resetting cannot be accomplished until the motor is stopped as the reset handle is on the cover which revolves with the pulley and which completely encloses the safety release.

Action of the safety device depends on the tension of a spring, a tension which can be adjusted to any desired value. As shown in *Fig.* 5, driving pins are attached to the web of the

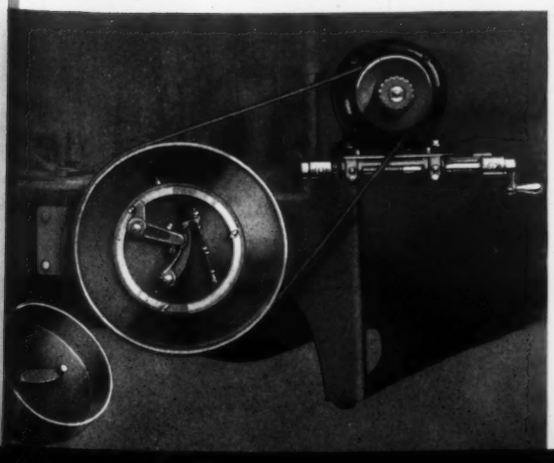


Fig. 5—Speed of machine may be adjusted exactly to that of co-operating units through variable speed motor pulley

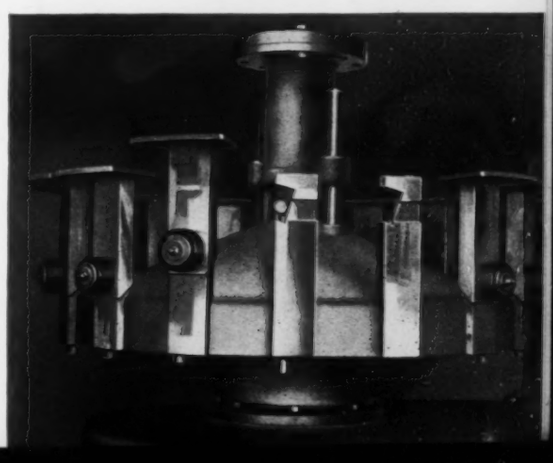


Fig. 6—Stainless-clad steel sheet is employed to resist corrosion of lifters which carry the bottles during filling

safety pulley which is free to revolve around the main shaft. A disk mounted tightly on the shaft carries a lever engaging any one of the driving pins so that, as the pulley revolves, disk and shaft rotate. In case of overload, the spring release bar yields and the lever instantly disengages the driving pin. As this pulley is directly geared to the discharge paddle, and from the shaft of this paddle to the other shafts of the machine, and as there is considerable work involved in moving the bottles through the machine, the entire machine will stop very quickly after disengagement of the pulley.

Synchronization Is Obtained

The discharge paddle was selected as the point to apply the drive as it is located at the center line of the base and as it has a little more load than the rest of the machine. This shaft is connected to the four other drive shafts of the machine and idler sprocket by heavy duty riveted roller chain which has hardened rollers, a drive method selected in order to permit ease of assembly, reduce the number of parts in the machine, and insure correct synchronization between the parts. *Fig.* 7 shows this drive.

The chain does not sag appreciably, both because of its design and because the sprockets are located close enough together to support it amply. It can be easily removed as it has two detachable links. Take-up for the chain is provided by the idler sprocket. The idler shaft is carried at one end of a lever. The other end of this lever is pinned to a shaft that passes up through the top of the base. A toggle bolt and

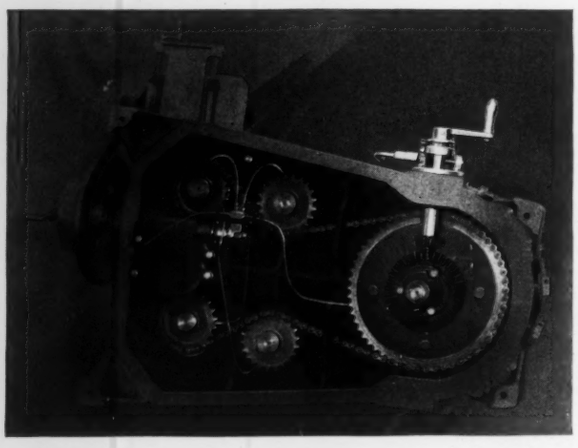


Fig. 7—Chain drive permits exact synchronization between co-operating shafts

lever on top of the base will turn the shaft, while a compression spring around the toggle bolt keeps the idler pulled up snug. An adjusting nut with lock nut may be adjusted outside the base as illustrated in *Fig.* 8.

Should a bottle jam, or a sudden load be thrown on the revolving parts, this spring-loaded idler would, of course, yield and might permit the chain to climb on one of the sprockets at the point where there is the most slack in the chain. This condition is prevented by a safety lock that is extremely simple. There is a sleeve around the toggle bolt. This sleeve is cut about 1/16-inch short to allow this amount of action under normal load. With a sudden load, the spring yields 1/16-inch and stops because the sleeve

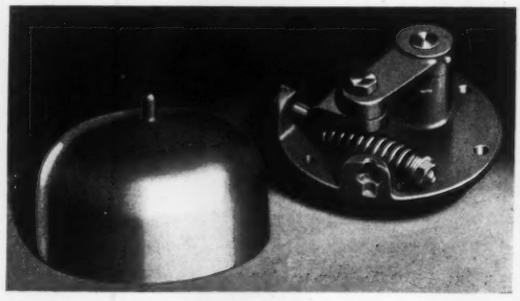


Fig. 8—Idler sprocket in the drive is kept tight by a compression spring

has come up to a stop collar. The overload is then taken care of by the safety clutch in the main driving pulley. Clearance on the safety lock also allows for the necessary tolerances in the center of the shafts and the cutting of sprockets.

Rotary Gear Pump Employed

Lubrication of the machine is accomplished by the use of a rotary gear type oil pump. The suction pipe of this pump extends down into the oil receiver. This receiver has two sections, a central portion from which the oil is drawn and a trough or moat around this section into which the oil from the machine must flow. Sludge, sediment, condensation, etc., are trapped out by settling to the bottom of the moat, while the oil overflows the top edge into the central section. Thus the oil is constantly being strained and sediment is being removed as long as the machine is being used.

Small pipes, shown in *Fig.* 7, lead from the oil pump to each of the vertical shafts. The pipes lead up inside the shaft housings to the top ball bearing, of the shielded type. The oil discharges on top of each ball bearing and flows through it and on down the shaft to the bottom of the housing. After it passes through the lower ball bearing, the oil is caught by the sprocket under that bearing and flows out to the teeth and chain. In this manner every moving part operates in a flow of fresh oil. A foot valve at the bottom of the pump suction keeps the system full of oil so that as soon as the machine starts the lubrication takes place. The oil overflowing through the opening at the bottom of the shaft provides a grease seal which protects the shaft and bearings against the effect of moisture.

SCANNING THE FIELD FOR IDEAS

THAT a good engineer to succeed must be original, never a copyist, does not imply that he should close his eyes to ideas that have not sprung from within him. The ingenuity of a man may reach exceptional proportions but there always are others equally as clever who are capable of producing a design of commensurate value. The alert engineer will constantly be in search for outside ideas by which his own will be supplemented and refined.

To those who may be laboring under the impression that there is but one best way, these words of an eminent engineer will provide food for thought: "In engineering, there is seldom just one way and only one way to accomplish a given result—nor is there just one best way. Generally speaking, I would say that there are about a thousand ways of designing any mechanical device. A dozen of them may be worth developing on the drawing board. A half dozen may be worth building experimentally; four or five may work out satisfactorily in practical usage. And of these four or five there are likely to be two or three designs where it is a toss-up as to which is the best."

Often an idea employed in a particular mechanism will suggest methods of obtaining similar results in other mechanisms. That is the premise upon which this department is built—it is conceived to serve as a clearing house for ideas.

ENHANCING APPEARANCE OF WELDING

IN DESIGNING for welding it is vastly more important that attention be given toward the elimination of sharp corners than it is in casting design. Castings, by the very nature of their production, have rounded corners and smooth lines, while a great many welded structures are made with two standard shapes, the corner of one overlapping the edge of the other so that a sharp corner is created.

That such sharp corners and consequent ungainly appearance are not necessary is indicated by the projection welder built by American Electric Fusion Corp., *Fig.* 1. For the base of this machine a formed plate is used with the front corners of the base, *A*, rounded to give a pleasing appearance. Further, at the junction of this base plate and the table, and at other right-angle joints, *B*, the plates are offset and a large bead applied to fill up the 90-degree angle. This gives the impression of a fillet. At breaks and joints, *C*, *Fig.* 1, the effect of the welding bead is softened by half oval beading that is attached by small plug welds placed alongside the welded joint. This small beading aids in improving the overall appearance of the machine in addition to eliminating the effect the weld might have on the appearance.

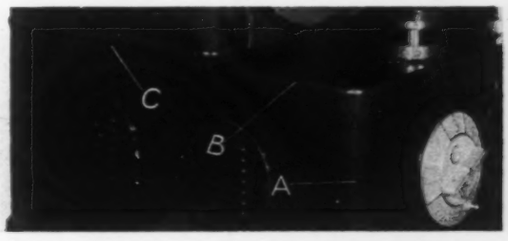


Fig. 1—Half oval beading attached by small plug welds effectively covers breaks and joints C

Thus, with a little care in design, welded structures can be made to appear as clean of line as will be desired in any machine.

COPPER PLATING ALUMINUM

FINISHES, by their constantly increasing variety, have extended the scope of design ideas. The interest in finishes has been unprecedented, primarily because they permit a wider selection of materials and furnish improved appearance that is the mark of good design. One of the latest methods, reported to have been developed in Germany, is claimed to produce a copper plating on aluminum that will not peel off and which is applied without the use of an electric current.

Aluminum articles to be plated first are polished with an abrasive and then placed in a cleaning bath which at the same time is a preliminary copper plating bath. This treatment

first removes completely the coating of oxide on the aluminum that otherwise is troublesome, and also produces a thin coating of copper on the metallic aluminum. As soon as this copper coating is formed, assurance is given that all traces of aluminum oxide have been removed. The articles then are taken from the bath and rinsed immediately in plain water and subsequently rubbed with a woolen cloth. This rubbing removes the black surface produced by the acid on the copper plating.

When the articles are dry they are placed in a second or the actual copper plating bath, in which plating of any desired thickness can be obtained. Thickness of the copper coating depends as usual on the time the articles are immersed in the bath, states the report made to the department of commerce by Rolland Welch, assistant trade commissioner.

EMPLOYING VACUUM FOR BRAKING

LATENT energy again is utilized by the designer. In this case vacuum created by the intake manifold of an automobile engine is employed to operate a brake, *Fig.* 3. A steel pipe

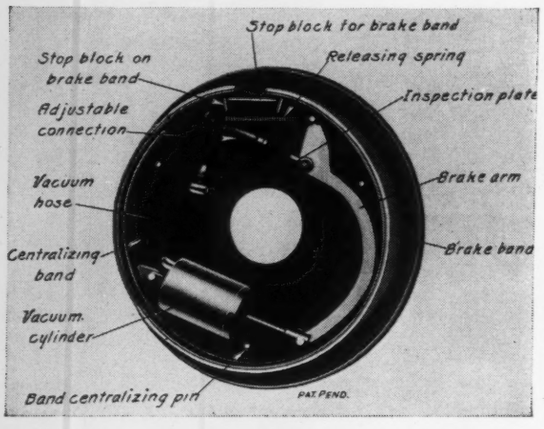


Fig. 3—Vacuum actuated cylinder is incorporated in design of auto brake to bring brake arm into operation

(not shown) connects the small vacuum cylinder in the brake head to the intake manifold of the engine. When a manifold valve operated by a foot braking pedal is opened, suction exhausts the air out of the vacuum cylinder, thus causing the plunger to be drawn into the cylinder.

The action forces out the brake arm and brings the brake shoe against a stop block. As the wheel turns the brake shoe is wound outwardly against the brake drum, also not shown. Effort of the wheel to turn increases the tendency for the band to wind out or expand until the entire surface of the band is pressed effectively against the drum. Davis Metal Fixture Co. has patented the device.

DIE CASTINGS FACILITATE COMPACTNESS

THIRTY-TWO die castings are embodied in the new General Electric workshop, a combination of six machines in one. These zinc alloy castings effect economical production of the various parts which include the motor base, saw and sand wheel tables, brackets, calibrated handwheels, etc.

By utilizing an ingeniously designed method of mounting, each attachment takes its power

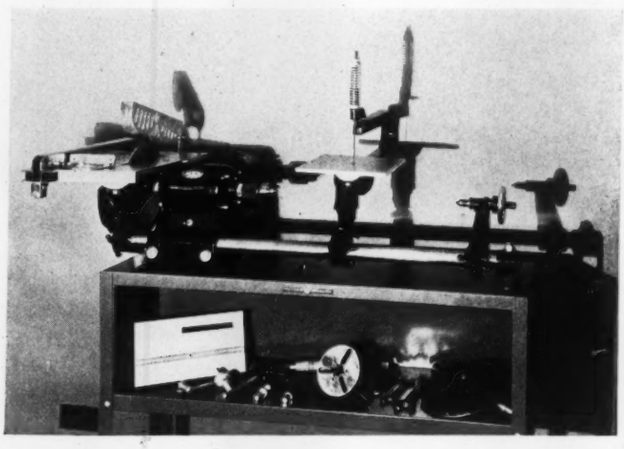


Fig. 4—Six workshop machines have been combined into one compact unit by ingenious use of die castings

direct from the motor for sawing, turning, drilling, sanding, mortising, etc. One pair of bearings takes care of all operations. Lightness of reciprocating parts has resulted in a design remarkably free from vibration. In order to solve the problem of mounting a machine of this type, there is included with the workshop a specially built steel cabinet which serves also for storage of the parts.

PLASTIC SELECTED FOR OILER BOTTLE

TRANSPARENCY of the new plastic known as Tenite admirably adapts it for use as the bottle portion of a new type oiler, *Fig.* 5, developed by Gits Bros. Mfg. Co. The application ruled out glass because of its tendency to crack or shatter when subjected to shock and vibration. One of the primary requirements for the fitting was a material that would be practically unbreakable; this cellulose acetate plastic provided the solution.

Consisting of a bottle and stem attached to a hinged metal fitting through which oil is fed to the housing of the bearing, the design of the device permits ready inversion of the bottle for filling. Even if a careless oiler should allow the bottle to strike against the machine the toughness of the plastic prevents breakage. Tennessee Eastman Corp is the producer of the plastic and developed the fabricating and cementing process

Fig. 5—Transparency combined with toughness adapt plastic material to use as bottle for oiler device

by which the bottle is molded in two pieces and cemented together.

CHANGES IMPROVE PERFORMANCE

RECENT important changes in design of automatic screw machines bring to attention the possibility of rotating stock tubes mounted on antifriction bearings. In the smaller Gridley units developed by National Acme Co. the spindle speeds made available by the use of modern bearings and forced feed lubrication systems have been increased substantially, so that it now is possible for a ⅞-inch machine to handle economically a ¼-inch brass rod. Without a unique change in design these increased speeds, however, would mean that if a crooked piece of bar stock 12 feet long is rotated at extremely high speed in the bar stock reel it is likely to have its corners rubbed off on the inside of the stock reel tube, if the bar stock happened to be square, hexagonal or some shape other than round.

To eliminate this possibility of damage to the work the stock reel tubes on these small machines are mounted on antifriction bearings and are free to rotate with the stock, *Fig.* 6. To give the stock reel the necessary rigidity a tubular backbone is welded into end disks, these in turn being mounted on rollers on stands which are adjustable so that they will line up exactly with the center of the machine.

The direct motor drive is designed so that the driveshaft of the motor becomes the driveshaft of the machine as well, thus eliminating in this case the use of sprockets and silent chain.

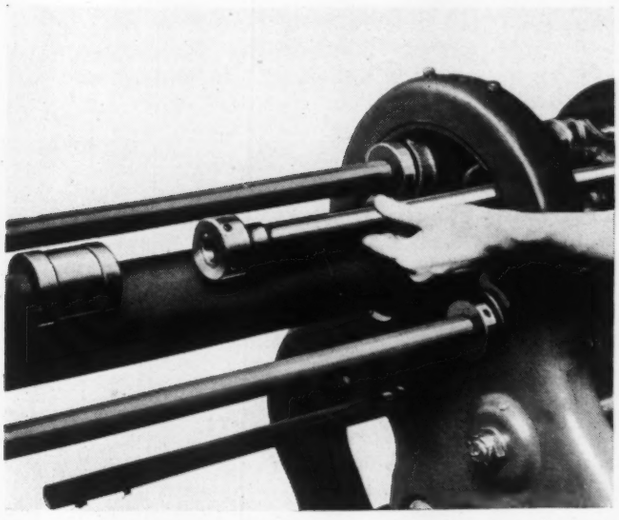


Fig. 6—Screw machine stock reel tubes mounted on antifriction bearings are free to rotate with stock

VENTILATION OBVIATES DANGER

IN THE design of a compact gasoline-electric drive built by the Ready-Power Co. for installation on equipment such as industrial trucks, an idea in ventilation has been incorporated that is worthy of note. The path of the air through the machine is the reverse of that in the conventional power plant.

Cold air is drawn into the unit, *Fig.* 7, through louvers at the generator end while the warm air is discharged through the radiator and louvers

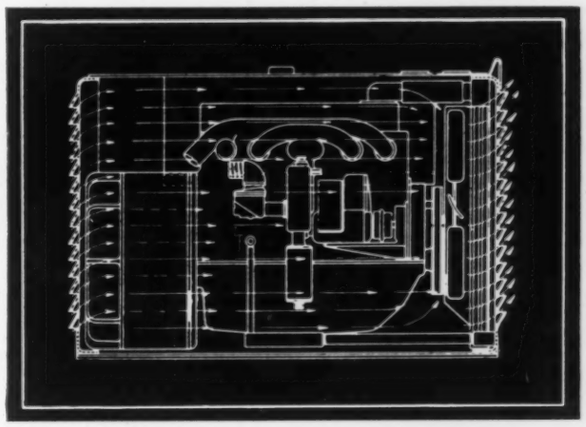


Fig. 7—Path of air in cooling system is arranged to eliminate danger of explosive gasoline vapor

at the engine end. This particular path of air circulation serves the following purpose: Cool air first strikes the generator, is drawn over the engine, magneto, oil pan and gasoline tank, and thus eliminates all possibility of dangerously explosive gasoline vapor coming in contact with the generator brushes.

In early models of the unit a series of holes was punched in the ends of the housing to act as intake and outlet ports for the air. The disadvantage of this arrangement was that the powerful fan for circulating the air caused a blast of hot air to be thrown far out into the surrounding atmosphere. The louvers as they now are designed direct the discharged warm air sharply upward where it cannot strike workmen alongside the truck.

Yield Point Is Paramount

By D. P. Forbes

MALLEABLE iron must be regarded as a working material. In other words it is more usually a component of machines than it is of static structures. It must have strength to withstand strains, and toughness to withstand abuse, according to the author, president of Gunite Foundries Corp., who presented the paper from which this article is abstracted, at the joint meeting of Western Society of Engineers and the Chicago sections of American Foundrymen's association and American Society of Mechanical Engineers.

The usual commercial analysis of malleable iron has a carbon content slightly under 2.50 per cent and a silicon content slightly under 1.00 per cent with other impurities such as manganese, sulphur and phosphorus within certain definite limitations. This material is poured into sand molds and solidifies as white cast iron. White iron is very hard and brittle and finds some commercial applications in wearing parts, such as sand blast nozzles cleaning stars and ball mill balls.

White iron castings which are to be malleabilized are heat treated or annealed in large ovens, usually being packed in containers with a sand or slag packing material, the principal purpose of which is to prevent warping of the castings. The heat treatment consists of holding the castings at a temperature of 1600 degrees Fahr. or more for a sufficiently long period to break down the iron carbide into two constituents; temper carbon nodules and a solid solution of iron carbide in iron. The castings are then cooled in such a way that the carbide is precipitated out of the solid solution as additional temper carbon, leaving an ultimate structure of soft iron and uniformly distributed nodules of temper carbon.

Unusual Uniformity Developed

When the metal reaches the purchaser's hands it will have a tensile strength ranging from 50,000 pounds per square inch for high carbon iron to 60,000 for low carbon iron, the increased strength apparently being due to the smaller percentage of temper carbon nodules which contribute nothing to tensile properties. Test bars with a rough sand cast surface on the outside will show unusual uniformity, the maximum variation from a 55,000 average being rarely more than plus or minus 3000 or 4000 pounds.

Malleable iron is unusual in that the yield point is a high percentage of the ultimate strength. For example, a malleable with 55,000 pounds ultimate strength will have a yield point of about 37,000, or 67 per cent, a high yield point, a good ductility.

Most malleable produced today is tough and ductile. The elongation of a $\frac{5}{8}$-inch diameter test bar in 2-inch gage length is above 15 per cent. Producers of low carbon malleable have no difficulty in averaging as high as 25 per cent.

The material has a number of fields of use-

Standard Specifications for Malleable Iron Castings

A.S.T.M. Designation: A 47 — 33

	Grade No. 32510	Grade No. 35018
Tensile strength, lb. per sq. in.....	50,000	53,000
Yield Point, lb. per sq. in.	32,500	35,000
Elongation in 2 inches, per cent	10.0	18.0

fulness where it is firmly entrenched. In the long run, a product will be purchased only if it fills the necessary requirements at the lowest cost. This can be illustrated by the use of malleable iron in the automotive industry. As an example, take the front hub of a passenger car. What property of the material makes it particularly suited for such an application? In the first place, the yield point of malleable is sufficiently high so that from a static strength standpoint the other materials offer no particular advantages. The ductility of malleable being over 15 per cent in most cases is adequate to provide sufficient toughness to withstand blows and road shocks without sudden failure.

Malleable iron finds many uses in the railroad field. Here, the machinability is of practically no consequence. What is wanted is a low cost, strong, tough material. It is specified extensively in railroad work because of its excellent corrosion resistance, due to the graphite content which tends to inhibit the penetration of rust.

In the agricultural field, malleable iron is used extensively because agricultural implements are badly abused. Most operating parts are not machined and smooth surfaces are necessary. The metal employed must be tough to withstand shocks encountered in service and it must be rust resisting to withstand the exposure to which

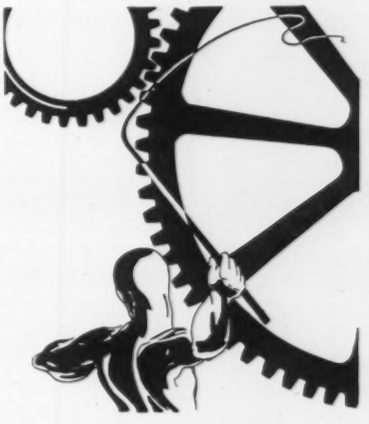
nearly all agricultural implements are subjected.

Other products have appeared on the market which are similar to malleable, except that they contain up to 0.80 per cent of combined carbon, as against malleable iron which contains practically none. The utility of these new products is great since care in manufacture will develop high tensile strength with reasonable ductility. A typical example of such a material would have a tensile strength of 90,000 pounds per square inch, a yield point of 70,000, and elongation of 16 per cent in 2 inches. Another type might have a tensile strength of 70,000 pounds per square inch, a yield point of 50,000 pounds per square inch, and an elongation of 16 per cent. The field of usefulness for such metals has not yet been adequately explored, but it is probable they will invade the present field of forgings, steel castings, and malleable iron. The handicap at the present time is the necessity for expensive equipment for the accurate heat treatment required to obtain uniformity.

These metals cannot be properly classed as malleable iron, and as yet no standard has been set by any of the engineering societies covering physical properties.

Machinery—

Or No Recovery!



MORE machinery and an unprecedented increase in production are important factors among the neglected elements of recovery, and they must be utilized in solving our present-day economic problem. This and other far-reaching observations were made recently in an address by Ralph E. Flanders before members of the American Society of Mechanical Engineers of which he is president.

Dividing the whole problem into four sections, Dr. Flanders analyzed in the order named, agriculture and industry, prices and wages, governmental expenditure and income, and recovery and reform. Particularly pertinent to designers and builders of machinery is the following excerpt from his discussion:

"The real answer to the problem of a simultaneous increased business output, increased profit, increased employment and a generally raised standard of living is the answer that shallow theorists deride, shortsighted labor leaders combat and timid industrialists avoid. The real answer lies in a renewed and continued application of more efficient labor saving machinery.

"This has been the answer of the past. This alone has raised the mass of the population above the level of primitive agricultural subsistence. This alone has given millions of workers the bath tub, the radio and the automobile. This alone will continue to provide these and newer comforts, and to extend them to millions of families now deprived of them. An immediate return to our former enterprise in the application of improved machinery will make possible that necessary decrease in prices without decrease in wages, will raise the standard of living, will raise the volume of business production, and will raise profits to the level required to support the industries producing these capital goods, whose workers are still largely unemployed.

"We need have no fear of thus returning to our old confidence in labor saving machinery. We have never yet on a fifty-hour week produced goods in a great enough profusion to give a decent standard of living to the average worker. The best of modern equipment will have to be built and installed and put to work on an enormous scale if the desired standard of living is to be possible on a forty-hour week—and here again is the means by which, when we recover our courage, we shall liquidate another of the great blocks of unemployment, that which is found in the equipment industries.

"But this return to our former initiative in the installation of new equipment requires a return to our old time courage and dependence on private enterprise."

"Super-Inventing" Is Function of

By George V. Woodling

A STRONG patent is the only kind worth while. If the patent is *strong,* it is usually not necessary for the owner to sue competitors for infringement. This is because the competitors will voluntarily respect the patent, either by acquiring a license thereunder or by discontinuing the manufacture and sale of infringing units. If the patent is *weak* the competitors will usually ignore it, knowing that the owner cannot afford to bother suing thereon. If the patent is *doubtful* the competitors may take a chance on infringement, because the owner may never bring a suit, particularly in the face of the large litigation expense usually involved and of the possibility of losing the suit.

In actual practice there is sometimes a tendency for the engineering department or the engineering inventors to forget about the process involved in obtaining their patents, after their inventions are once turned over to the patent department, or to an outside patent attorney if the company does not maintain a patent department. This is the wrong way to obtain a good patent. If the patent attorney is resourceful and persistent he may get a satisfactory patent, but otherwise not. The best way to secure a good patent is to maintain a high degree of co-operation and exchange of ideas, not only between the patent department and the engineering department, but also between the patent department and the commercial and executive departments (see the organization chart in *Fig.* 1). This co-operation is overlooked in many organizations, to the detriment of the companies' interests.

Copyright, 1935, by George V. Woodling

The process of prosecuting a patent application into a strong patent may be generally referred to as "super-inventing," that is, "inventing over the invention itself." Not in the sense, however, of changing the mechanical features of the commercial embodiment of the invention, but in the sense of broadening the scope of the patent protection to embrace all modifications thereof, as well as whatever new devices may be invented in the future. In other words, "super-inventing" attempts to forecast the development

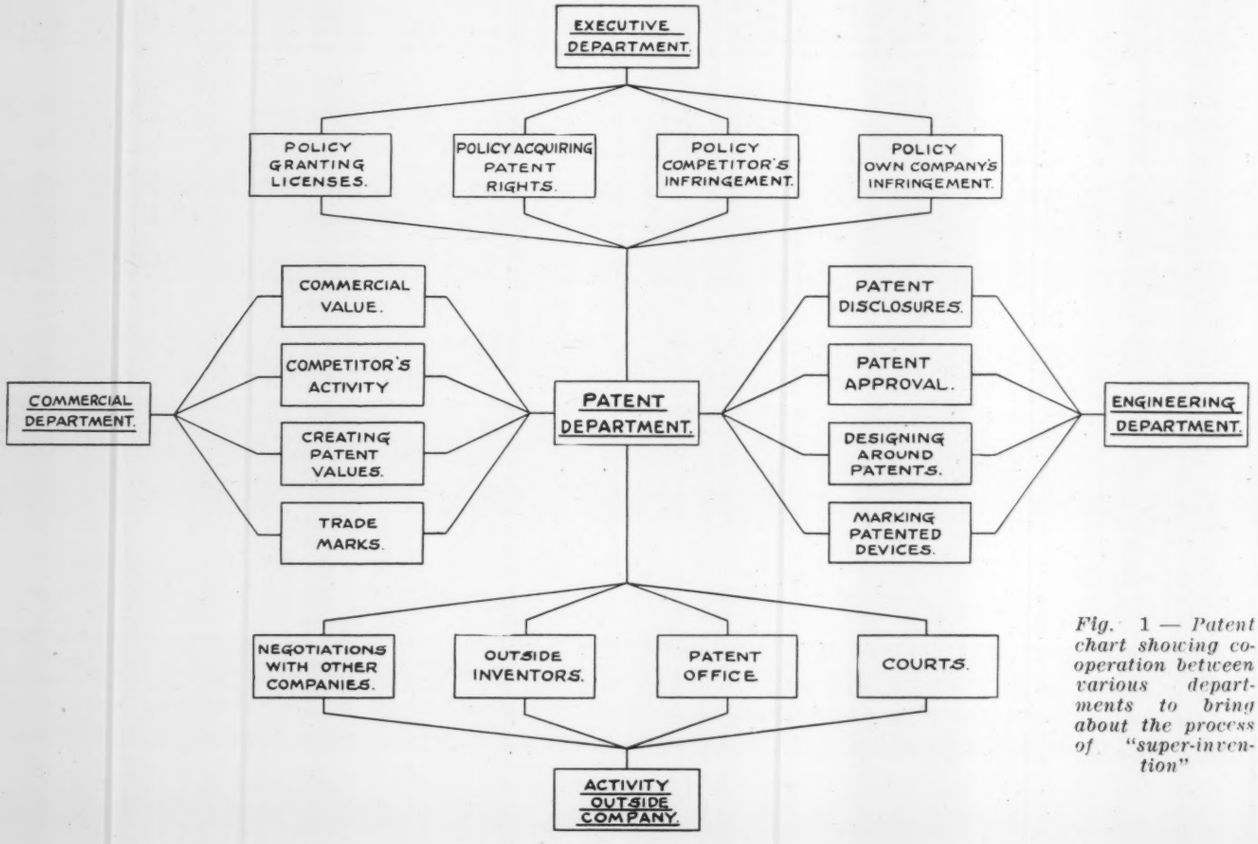


Fig. 1 — *Patent chart showing co-operation between various departments to bring about the process of "super-invention"*

Patent Departments

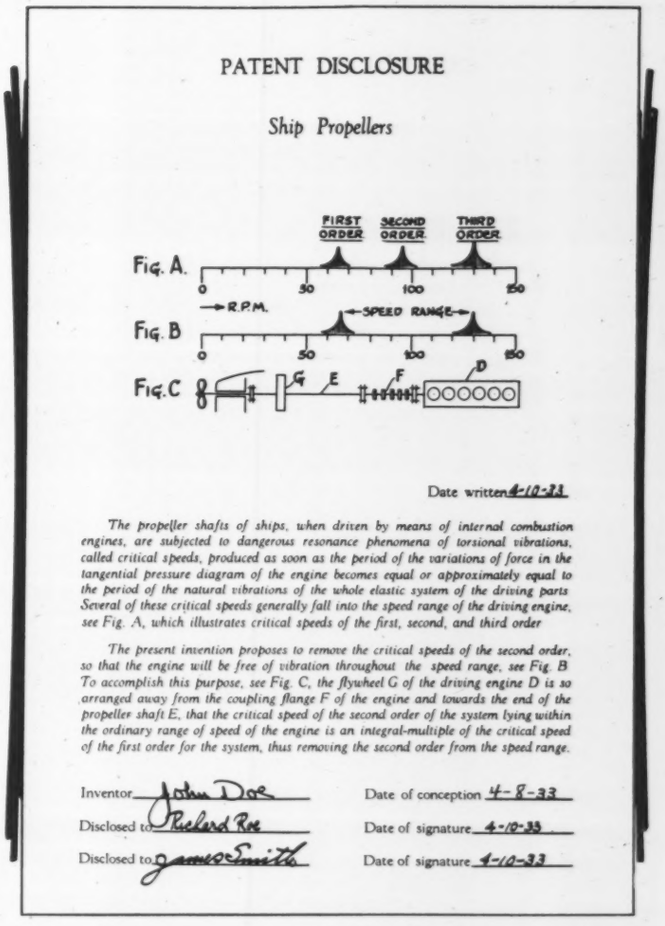
which may be made during the ensuing seventeen years, the life of the patent. The atmosphere in which "super-inventing" exists is saturated with engineering, commercial, and executive ideas which enter into the life of the patent to make it valuable, during the time application is being put through the patent office.

For example, let us suppose that the patent attorney is discussing the possibilities of a new machine with the chief engineer and the sales manager of a company. In this discussion the sales manager will vision an increased volume of sales, and the chief engineer will vision new ways of perfecting and manufacturing the machine at a low cost. Because of his intimate contact with the buying public, the sales manager may conceive the idea of how one or more of the parts of the new machine may be sold

AN INVENTION is only as good as the patent which protects it, and a strong patent can only be secured by the utmost co-operation and interchange of ideas between departments, as brought out in this last article of the series on patents which has been presented in MACHINE DESIGN. Mr. Woodling, practising attorney engaged in patent and engineering developments in Cleveland, holds two engineering degrees as well as a law degree.

separately as a replaceable unit, not only in connection with the new machine but also in connection with other unrelated types of machinery. The patent attorney, realizing the importance of the sales manager's idea, will then direct his patent protection to cover the separable and replaceable parts by separate claims, as well as by claims covering the entire machine. Also, the chief engineer may suggest several modifications in the design of the machine, which may be covered by additional patent claims. In discussions of this type, one idea paves the way for the next, until a vast amount of valuable information is obtained which enters into the life of the patent and makes it strong. The foregoing illustrates the value of "super-inventing."

To overlook one single provision arising from such discussions may mean the difference


PATENT DISCLOSURE

Ship Propellers

Date written 4-10-33

The propeller shafts of ships, when driven by means of internal combustion engines, are subjected to dangerous resonance phenomena of torsional vibrations, called critical speeds, produced as soon as the period of the variations of force in the tangential pressure diagram of the engine becomes equal or approximately equal to the period of the natural vibrations of the whole elastic system of the driving parts. Several of these critical speeds generally fall into the speed range of the driving engine, see Fig. A, which illustrates critical speeds of the first, second, and third order.

The present invention proposes to remove the critical speeds of the second order, so that the engine will be free of vibration throughout the speed range, see Fig. B. To accomplish this purpose, see Fig. C, the flywheel G of the driving engine D is so arranged away from the coupling flange F of the engine and towards the end of the propeller shaft E, that the critical speed of the second order of the system lying within the ordinary range of speed of the engine is an integral-multiple of the critical speed of the first order for the system, thus removing the second order from the speed range.

Inventor John Doe — Date of conception 4-8-33

Disclosed to Richard Roe — Date of signature 4-10-33

Disclosed to James Smith — Date of signature 4-10-33

Fig. 2—Specimen of engineering department disclosure illustrating manner of submitting record of invention

between a valuable patent and a worthless patent, and the regrettable part about it is that this weakness is ordinarily not discovered until a competitor enters the field with a modified device, and an unsuccessful attempt is made to stop him. Instead of waiting until the engineering-inventor has completed the development of a new machine, the patent attorney should contact the engineer at the outset and follow the engineering development through its various steps. This co-operative relationship works both ways. The inventor is helped because the patent attorney is in a good position, by reason of his knowledge of prior patents, to guide the development along lines as to avoid infringement. The patent attorney is helped because he has first-hand and intimate knowledge of each of the new developments which enter into the completed machine. This enlarges the vision of the patent attorney and enables him to secure an excellent patent.

In some manufacturing companies the service of the patent attorney is so valuable that he participates in the allotment of funds for research and development purposes. In this manner the overlapping of research and development work is avoided, for the reason that the patent attorney can make a patent search of the prior art and enable the engineer to be-

gin his development where the prior art left off.

As each engineer makes an invention, he should be instructed to prepare immediately a patent disclosure and turn it over to the patent department. A typical example of a patent disclosure is shown in *Fig.* 2. No particular form is necessary in preparing the patent disclosure, but the thing to remember is that the written description and drawings must be clear enough to enable any engineer, after reading the disclosure, to make the invention without resorting to re-inventing the machine all over again. Some manufacturing companies, in order to standardize the forms of their disclosures, use a disclosure book in the engineering department.

It is a good plan for the patent department, after receiving a patent disclosure, to check the commercial value of the invention before spending too much time and money upon patent protection. The device may sparkle with inventive ingenuity but possess very little commercial value. If the commercial value is apparent upon the face of the invention the patent department may file an application without consulting the commercial department. But usually many inventions have a questionable value, and here the service of the commercial department will be desirable in determining the sales merits of the invention.

Factual Report Desirable

It is easy enough to get a sympathetic commercial expression, not based upon fact, but it is a hard job to get a good and fair commercial report based upon facts. Where the invention is small it may be embodied into several life-sized models and sent to the salesmen in the field who may contact potential customers to obtain their sales reaction. If the invention relates to a fairly large machine in which it would be expensive to construct a full-sized model, an artist may be employed to make photographic illustrations of the machine as it will appear, if, when, and as constructed, see *Fig.* 3. These photographic illustrations may be sent out to the salesmen in the field where the purchaser's reaction can be obtained.

If the report of the market survey is favorable, the patent department may then proceed to file the necessary patent application to protect the device. The object of a market survey is to serve as a check on filing on every disclosure that is submitted to the patent department. Among patent disclosures, there are many border line inventions which have a questionable value, and the purpose is to exclude these unimportant cases and concentrate all effort of the patent department upon the prosecution of the valuable invention, because the main purposes of the department is to safeguard the progress of the more valuable engineering developments.

It must not be understood, however, that the commercial value as determined by a market survey is the sole criterion of gaging the value of a new device. Sometimes an invention is born ahead of its time, and may for this reason possess little commercial value at the time a market survey is made. In this case the prosecution of a patent application may be somewhat delayed until the market is ready for such a device. It is a dangerous policy, however, to refrain from filing on certain inventions just because the invention does not have any immediate commercial value. In cases of this nature the main thing to keep in mind is whether or not the invention, even though it may never be manufactured and sold, augments the general patent situation of the company. In other words, the invention may bridge the gap between the devices which are being manufactured and sold, and thus prevent a competitor from wedging his way into the field through an unprotected gap.

Must Test for Infringement

If the invention possesses immediate commercial value and the company desires to manufacture and sell the invention, the next duty of the patent department is to determine if the device when manufactured and sold would infringe the claims of any existing patent. This is generally referred to as "patent approval." If the patent department finds that there is a possibility of an infringement, this is called to the attention of the engineering department so that the design of the device may be changed to avoid the claims of the prior patents. It is surprising to learn how the ingenuity of engineers can suggest ways of avoiding the claims of prior patents. Invariably, when the engineers are finished in designing around claims, they not only have a device free of infringement but also have a unit that is cheaper and more salable than the infringed device.

Sometimes it is impossible to design around a large group of prior patents. While avoiding one patent, the design runs counter to another patent. When a situation like this arises the

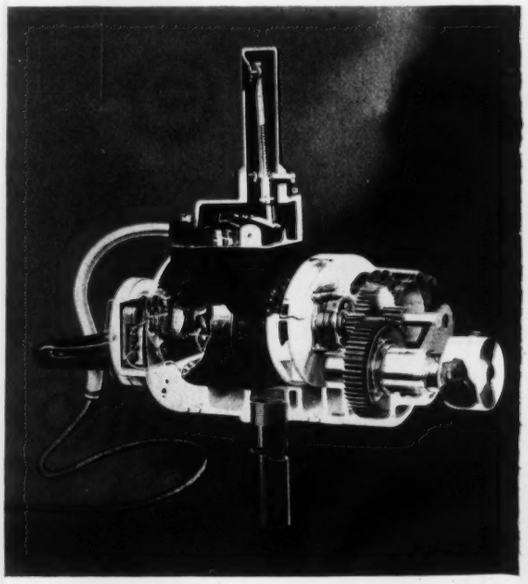
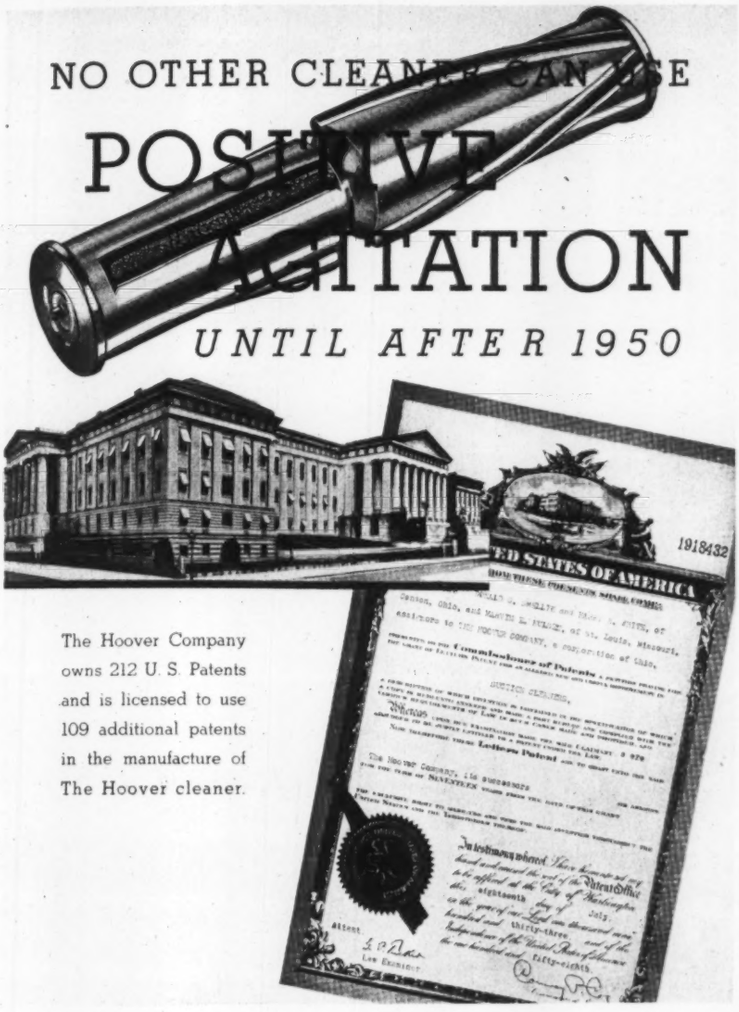


Fig. 3 — *Photographic representation of proposed machine aids in determining commercial possibilities*



The Hoover Company owns 212 U. S. Patents and is licensed to use 109 additional patents in the manufacture of The Hoover cleaner.

Fig. 4—Patent values may be created by advertising the patent and its advantage to the purchaser of the machine

matter is taken up with the executive department to decide upon the policy of acquiring patent rights under the group of patents, or at least part of them. If the prior patents are strong, the only safe policy to adopt is either to acquire rights thereunder or to refrain from manufacturing the device. If the strength of the prior patents is questionable or weak, the executive department may decide that the company can afford to take a chance upon infringement.

But in making such decision, the executive department should not feel too optimistic. Other things being equal it generally is advisable for the executive department to resolve such doubt against the company, for the reason that a successful plaintiff in a suit on a patent may be awarded damages as well as the profits of the defendant. This precaution is particularly true where a judgment of a court is collectable against the infringing company. This policy of precaution leads to the apparent tendency of asserting restricted interpretation under the company's patents and of recognizing a liberal interpretation under the competitor's patents. Such a policy is frequently criticized by the commercial department and accounts for the attitude on the part of the company's salesmen that the competitor always has the best patents.

In addition to designing around adversely-held patents, there is another co-operative function between the patent department and the engineering department. This is in the marking of the patented devices as covered in MACHINE DESIGN for July, 1934, page 27.

Throughout the course of prosecuting patent applications it is advisable for the patent department to keep in close touch with the commercial department as to the activity of competitors. It may so happen that one or more competitors, after examining the new device, will decide to enter the field and attempt to reap some of the commercial profits. The competitor may, or may not, construct his device substantially like the company's device. If there is a modification or departure, the commercial department should call this to the attention of the patent department, in which case the patent department may be able to draft additional claims to cover the modifications and departures of the competitor's device. In this manner, when the patent once issues, the company will be in a good position to stop the competitor. Otherwise the patent might have issued without sufficient protection.

Should Create Patent Values

There is another very important relation between the commercial department and the patent department which is often overlooked, and that is the phase of *creating patent values*. Ordinarily there is a tendency, when once a company obtains a patent, to put it away in their files and forget about it, unless it is necessary to drag it out and use it against a competitor who is just entering the field. Under this method the patents are not utilized to their greatest commercial value, except only to stop competitors. There are many ways in which the commercial value of patents may be created. They can be used as a means to bargain in acquiring new customers. They can be used very effectively in sales promotion work and advertising programs. A good example of creating patent values by advertisement is illustrated in *Fig.* 4. Closely associated with creating patent values is the matter of trademarks, which is taken up with the commercial department.

The patent department also has as one of its many duties the investigation of the merits of invention submitted to the company by outside inventors. As a rule, quite a few of these outside inventions possess little value. In these cases, the matter is usually handled by advising the inventor that the company is not interested. On the other hand, where the outside invention possesses considerable value the negotiations, in some cases, take on an extended form and this may continue for a considerable length of time. There is one thing that should be guarded against when dealing with outside inventors,

(*Concluded on Page* 68)

Melting Points, Heat Colors, Conversions— At a Glance

CONVERSION of temperatures from one scale to another has been a mathematical chore for which engineers have adopted one short-cut after another. An additional step in means for simplifying this conversion is the Fahrenheit-Centigrade temperature chart shown herewith, which also includes melting points of various metals and alloys, at the left of the scale, and color designations commonly used in judging the temperatures of hot metal by color, at the right.

As is known, on the Fahrenheit scale the freezing point of water is 32 degrees and the boiling point 212 degrees. On the Centrigrade scale 0 degrees is the point at which water freezes and 100 degrees the boiling point. Thus 100 divisions on the Cent. scale equals 180 divisions on the Fahr. scale. This makes 1 degree Cent. equivalent to 9/5 (180/100) of a degree Fahr. Numerically then to convert from Cent. to Fahr.:

$$degree\ Fahr. = 9/5\ degree\ Cent. + 32$$

Or to convert from Fahr. to Cent.:

$$degree\ Cent. = (5/9)\ (degree\ Fahr. - 32)$$

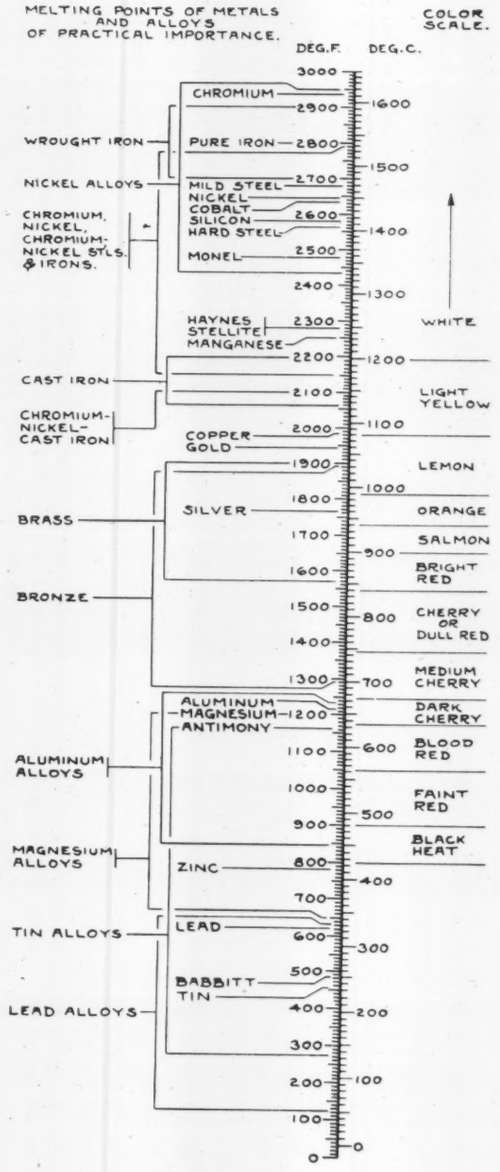
These formulas may be easier to remember in the following form:

$$degree\ Fahr. = (degree\ Cent. \times 1.8) + 32$$
$$degree\ Cent. = (degree\ Fahr. - 32)/1.8$$

The melting points shown as single temperatures are for metals that are elements. Each group of alloys has a range of melting points due largely to the effect of even a small change in relative composition. The ranges shown are, however, indicative of the relationship in melting point between a metal and its alloys and between different groups of alloys.

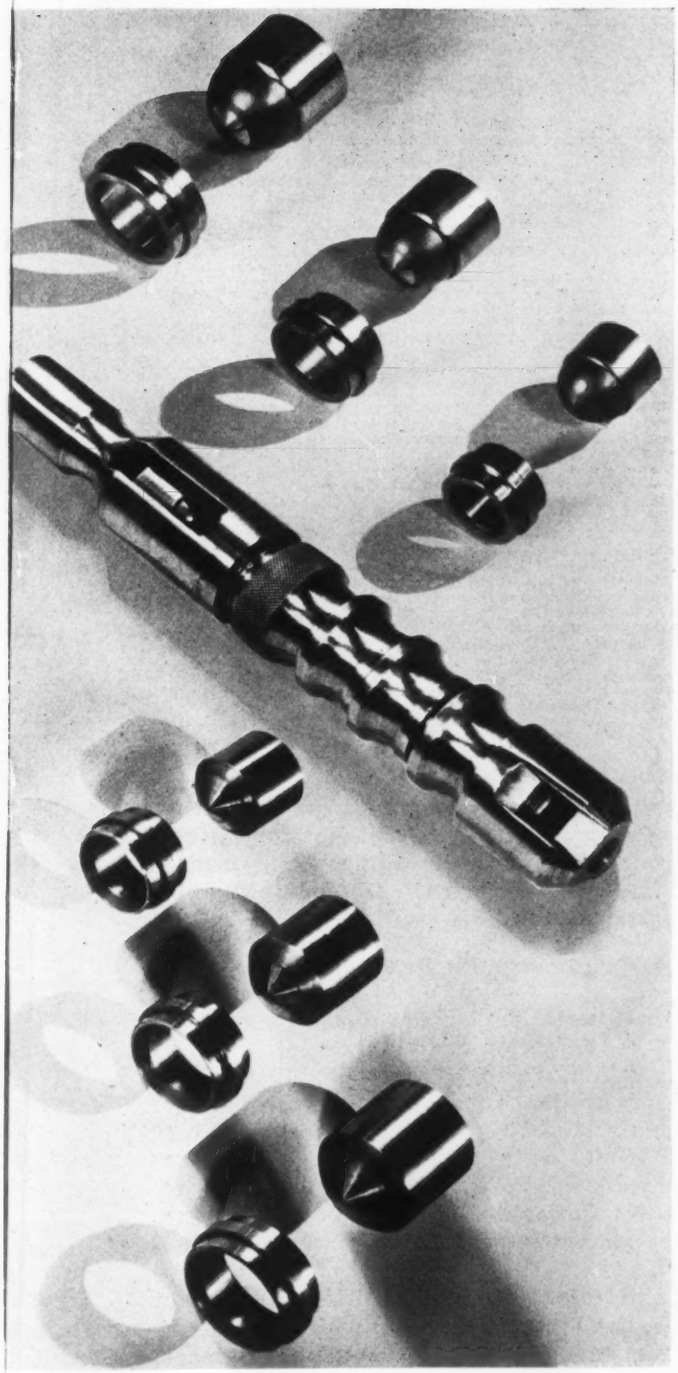
The temperature color chart can, of course, merely suggest the relationship between heat colors of metals and temperatures. Observations should be made in the dark for best results.

This chart was prepared by Linde Air Products Co., and presented in the publication of that company, *Oxy-Acetylene Tips*.



This chart facilitates the conversion of temperatures from Fahrenheit to Centigrade or vice versa. Melting points of various metals and alloys also are given

New Alloy Gives Hardness, Strength, Resists Corrosion



Material is specially suitable for parts operating under severe conditions such as these drop and seat valves

Nickel (min.)	Copper (min.)	Aluminum (max.)	Carbon (max.)	Other Metals (max.)
63%	25%	5%	.20%	5%

●●●●● Not just another table of chemical composition, but the composition of a new Monel alloy that is both corrosion resistant and as strong as heat treated alloy steels.

Chief engineers and designers are displaying intense interest in this material because of its suitability for machine parts. Known as K Monel, it is a nonferrous alloy produced by the addition of a small amount of aluminum to Monel metal. An analysis typical of present production might show:

Nickel	63.32	Manganese	.50
Copper	30.84	Carbon	.16
Aluminum	3.45	Silicon	.20
Iron	1.50	Sulphur	.005

The primary reason for the selection of this material for engineering uses rests on the high strength, ductility and hardness that may be developed by heat treatment. In its hardest grade it has a proportional limit in excess of 100,000 pounds per square inch, tensile strength in excess of 160,000 pounds per square inch with elongation (in 2 inches) over 15 per cent, combined with the corrosion resistance of Monel metal. Tempered to lower hardness, the ductility is greater and the strength less. The properties and hardness are given in TABLE I, on the following page.

Hardening is accomplished by quenching from 1450 degrees Fahr. or higher followed by reheating to 1000-1100 degrees Fahr. and holding at that temperature for approximately eight hours. Heat treated K Monel may be partially softened by heating the metal to 1200-1400 degrees Fahr. and cooling in air. To obtain complete softening, the metal is quenched in water or oil from 1450 degrees Fahr. or higher.

The elastic moduli of the new material are the same as those of Monel metal: Modulus of elasticity in tension, 26,000,000; modulus in torsion, 9,500,000.

Wire of K Monel can be drawn and heat treated

to 175,000—200,000 pounds per square inch. This wire retains its properties at temperatures up to 400 degrees Fahr. The torsional proportional limit is about 80,000 pounds per square inch.

The alloy also is useful for springs in large sizes which cannot readily be fabricated wholly by cold process. Springs can be made from soft rod or formed hot and the spring temper developed by heat treatment. In this case the proportional limit and breaking strength will be high, depending upon the size of the spring and the amount of cold work developed by the coiling. Breaking strength of 175,000 to 200,000 pounds per square inch is developed only by combining 75 per cent cold drawing with heat treatment and cannot be reached in springs made by hot forming.

Endurance testing has been carried out and the results carefully checked. These results indicate that the endurance limit in the fully heat treated condition is approximately 36,500 pounds per square inch. In the soft condition the endurance limit is 26,000 pounds per square inch.

Discusses Impact Resistance

The impact resistance of K Monel decreases with increasing hardness. In the soft condition it has an impact value of 100 to 200 foot-pounds, Izod. At maximum hardness the impact value is reduced to approximately half that of the softest grade.

In the most commonly used hardness, 275 to 325 Brinell, the impact values compare favorably with heat treated, low alloy steels. Nonmagnetic under ordinary working conditions, K Monel remains so at subnormal temperatures.

The new material can be machined quite readily and at practical production rates in its softer grades. In its hard grade it also can be machined at slow speeds with especially hard tools, e.g. Carboloy, but this is not recommended and can usually be avoided by machining before final heat treatment, followed by grinding.

Corrosion resistance of the alloy is equally as good as that of Monel metal. It resists the action of practically all acids, alkalis, salts, waters, food products, organic substances and atmospheric conditions at normal and moderately elevated temperatures.

TABLE I

Mechanical Properties

Hardness Grade	Tensile Strength Lbs. per sq. in.	Yield Strength at 0.5 per cent. Elong. lbs. per sq. in.	Proportional Limit Lbs. per sq. in.	Elongation per cent. in 2 in.	Reduction of Area per cent.	Brinell Hardness Range 3000 Kg.
A	120000 max.	80000 max.	60000 max.	40 min.	50 min.	Softer than 225
B	120000 min. 140000 max.	80000 min. 100000 max.	60000 min. 80000 max.	30 min.	35 min.	225–275
C	140000 min. 160000 max.	100000 min. 120000 max.	80000 min. 100000 max.	20 min.	25 min.	275–325
D	160000 min.	120000 min.	100000 min.	15 min.	20 min.	Harder than 325

Notes referring to Table I: A is the softest grade obtained by a softening heat treatment. It will be specified where greatest softness is necessary for fabricating operations. Parts made from Grade A will in most cases be hardened by heat treatment after fabrication. The values of tensile strength, proportional limit and yield strength are maxima for this grade.

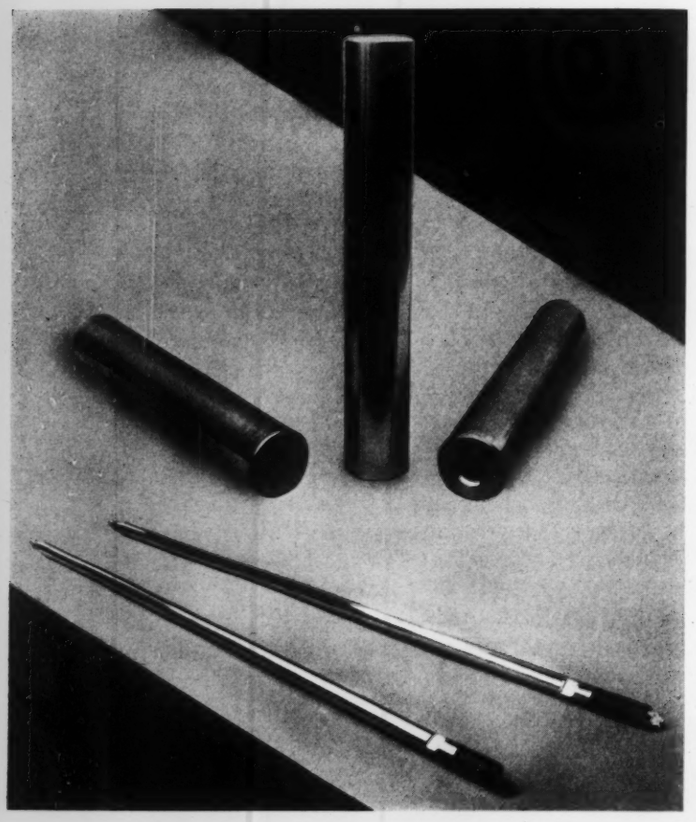
Hardness Grade A may be produced by hot rolling or forging. All Grade A is quenched off the hot rolling mill and shipped in that condition. This eliminates the necessity of the softening heat treatment by the purchaser.

Grades B and C are intermediate. The minimum values of strength and ductility are to be considered typical in each case and the producer will aim to deliver the minimum strength values for the grade. The upper limits are set forth only as the boundary of the next higher grade. Grade C is the strongest grade that can be machined to advantage. Grade C will be specified in cases where parts are to be machined and used without further heat treatment.

Grade D is the cold worked and fully heat treated alloy in its hardest and strongest condition. Grade D can be machined only with difficulty. This grade should be specified for parts where highest hardness and strength are desirable and where low ductility is not detrimental. Grade D can be used for parts purchased finished or that can be finished by grinding.

The Brinell hardness range values are given as an indication of the equivalent hardness of each grade.

Corrosion resistant plungers and piston rods that have been machined, heat treated and finished by grinding



Saves Weight Besides Resisting Corrosion

Principal uses so far developed have been where either corrosion or weight saving has been the determining factor. Where the strength requirements are those for which heat treated carbon steels will suffice and the corrosion factors demand Monel metal, the standard alloy offers the necessary strength. Where the strength demand is for the equivalent of heat treated, medium carbon alloy steels, then K monel should be specified.

Through offering high hardness and great strength, combined with good ductility and corrosion resistance, this material offers an opportunity for the designer to employ high unit

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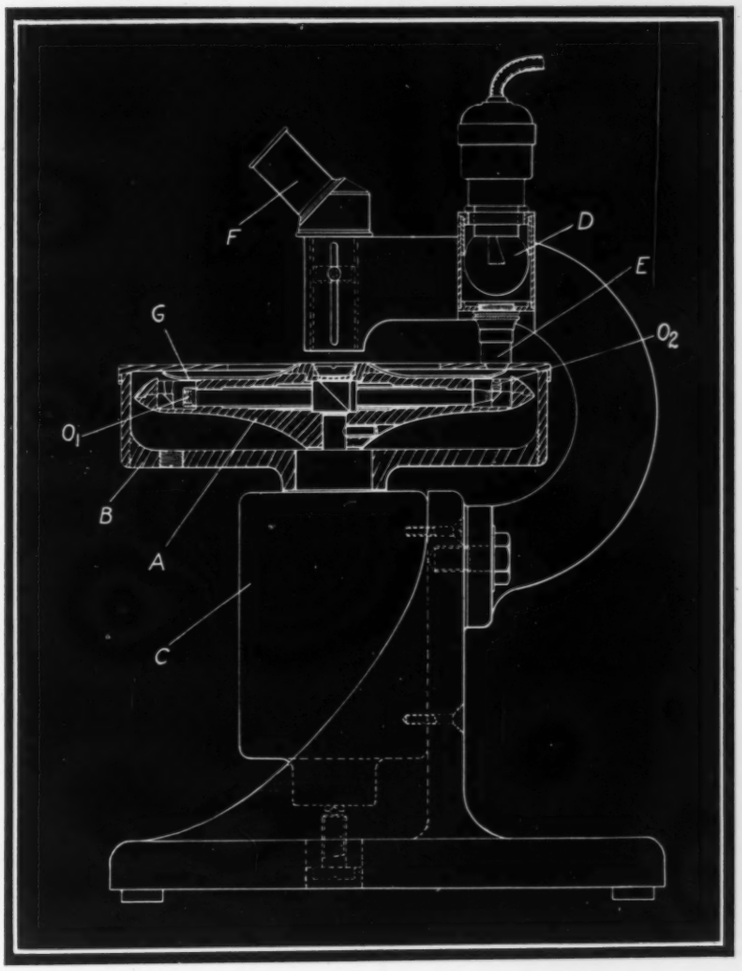


ILLUMINATING system of this centrifuge microscope uses principle of motion pictures. It is speeded up to 166 images per second

Whirling Disk Utilizes Aluminum

By G. Fassin

BY EMPLOYING ideas growing out of past experiences in design, a machine that once was a microscopist's vague desire now is an accomplished fact. The instrument in question is a centrifuge microscope by which specimens can be observed while being revolved at the rate of four miles a minute—10,000 r.p.m.

To enable the motor to drive the nine-inch rotor *A*, *Fig.* 1, at this high speed it was necessary to employ streamlining to reduce wind resistance, air friction and whirls. Moreover, the rotor is entirely enclosed, the inside walls of guard *B* being chromium plated and polished. By holding flywheel effect to a minimum, starting and stopping lag also are reduced.

Motor Heat Dissipated

The rotor is composed of two disks of aluminum with a tensile strength of 55,000 pounds per square inch. Lower curve of this member is undercut from the theoretical curve to produce a suction of air which dissipates the heat generated by the motor The rotor must be kept cool to avoid evaporation of the liquid specimens placed on top of the rotor in the position shown at *G*.

Inside the rotor two microscopic objectives O_1 and O_2 are placed, with a right-angle reflecting prism in the center. This prism can be turned in order to take in light through O_1 or O_2 and reflect it into eyepiece *F*. The magnifications obtained with a 10X eyepiece are 100X and 400X. The illuminating system is an ingenious arrangement which uses the principle of motion pictures except that it is speeded up to as high as one hundred and sixty-six images per second.

In the arm of the instrument is built a light source *D* which through condenser *E* sends a slit of light covering approximately a quarter of a degree of the circumference of the rotor so that for a speed of 10,000 revolutions per minute the light impulses reaching the eye are of the order of 1/300,000 of one second, but repeated 10,000 times a minute these impulses give the impression of a continuous image when observed through the eyepiece *F*.

Specimens are placed in a special glass slide which is maintained in position *G* by means of a steel spring clip above the objectives O_1 and O_2. On the side opposite the glass slide is placed an aluminum plate of exactly the same weight as the specimen slide.

The force developed by this centrifuge is 12,000 times gravity. In other words, one ounce placed at the location of the slide and traveling with a speed of approximately four miles a minute produces an outward pull of 12,000 ounces, or 750 pounds. The instrument, developed by Bausch & Lomb Optical Co., is used in bacteriology, biology, pharmacodynamics, and in various cases where an observation of the centrifugal processes of extreme value in the study of the specimen.

What's Behind the

By Robert R. Tatnall

THE most recent solution of the problem of the short-center drive is furnished by the pivoted-motor base in combination with a flat leather belt. An adjustment in the arms allows the motor to be moved toward or away from the pivot, thus regulating the lever arm of the motor weight and giving a wide choice of belt tensions.

By a simple application of fundamental dynamics, the tensions in the two belt strands of a pivoted-motor drive may be obtained when the motor weight, the belt speed, and the geometry of the layout are known.

Conversely, it is not difficult to calculate for a given drive how far behind the motor shaft the pivot must be placed, in order that the ratio of the tensions shall have a predetermined value.

The rotor and stator of the motor, including the two base-arms, constitute a dynamical system which is in rotational equilibrium about any horizontal axis. A mathematical statement that such equilibrium exists is to be obtained by equating to zero the sum of the moments about such axis, of all the external forces.

Aside from wind resistance, there are four external forces acting on the motor system of *Fig.* 1. These are the force of gravity W, the tight and slack-side belt tensions T_1 and T_2, and the force Z exerted by the pivot. The magnitude and direction of Z are unknown. W acts through the center of gravity of the system, which with small error may be assumed to lie in a vertical line through the center of the motor shaft.

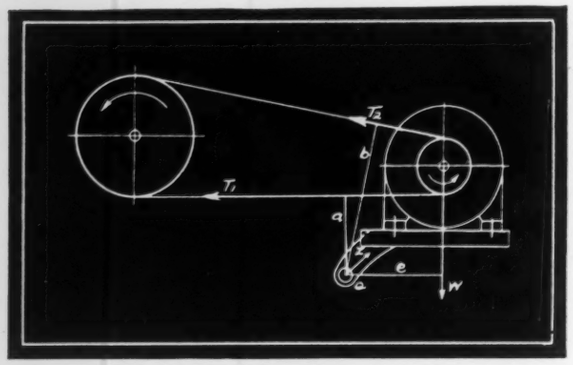


Fig. 1—*Four external forces act on a belted pivoted-motor system, besides wind resistance*

To determine the unknown tensions T_1 and T_2 two relations between them are required. Taking moments about the pivot Q, in order to eliminate the unknown moment of Z, calling a, b, and e the lever arms about the pivot of T_1, T_2, and W, respectively, and regarding counter-clockwise moments as positive.

$$aT_1 + bT_2 - eW = 0 \quad \text{.....(1)}$$

A second relation between the tensions is supplied by the fact that the transmitted load is

OF all short center drives, perhaps the least understood is the type involving a pivoted motor. Dr. Tatnall, research engineer with J. E. Rhoads & Sons, gives the theory and design behind this class of drive in a paper to be presented at the semi-annual meeting of the A.S.M.E. at Cincinnati, June 19-21. The accompanying article is an advance abstract of his paper.

proportional to the product of tension difference and belt speed, as expressed by

$$T_1 - T_2 = kP \quad \text{.....(2)}$$

in which

P = load transmitted in horsepower

$$k = \frac{33{,}000 \times 12}{Nd\pi} = \frac{126{,}000}{Nd} = \frac{33{,}000}{\text{belt speed in fpm}}$$

N = motor speed, rpm

d = diameter of motor pulley, inches

From equations (1) and (2) the two belt tensions in terms of motor weight, load, speed and the three lever arms are obtained as follows:

$$T_1 = \frac{eW}{a+b} + \frac{bkP}{a+b} \quad \text{.....(3)}$$

$$T_2 = \frac{eW}{a+b} - \frac{akP}{a+b} \quad \text{.....(4)}$$

And from these

$$T_1 + T_2 = \frac{2eW + (b-a)kP}{a+b} \quad \text{.....(5)}$$

$$T_1/T_2 = \frac{eW + bkP}{eW - akP} \quad \text{.....(6)}$$

If we imagine the load to be increased until it reaches the value $P = eW/ak$, so that

Pivoted-Motor Drive?

$eW—akP = 0$, then $T_2 = 0$ and $T_1/T_2 =$ infinity. This is a theoretical limit to the load which cannot be exceeded without changing the assumed arrangement of the drive. Indeed, excessive slip will occur considerably below this point, and experiment has shown that the practical limit of load is reached at somewhere near 75 per cent of the theoretical maximum.

Putting $P = 0$ in Equations (3) and (4), $T_1 = T_2 = eW/(a+b)$, which gives the stationary or idling tension in either belt strand. The second terms give the changes in tension, (increase or decrease as the case may be), caused by applying a load of P horsepower. These terms involve also the belt speed, factor k.

If a and b are positive, and the speed is constant, the equations show that any increase in the load will cause an increase in the tension of the tight strand and a decrease in that of the slack strand. In the usual fixed-center drive this always happens. In the pivoted-motor drive it usually happens, but not always, since there are cases in which a or b may be negative.

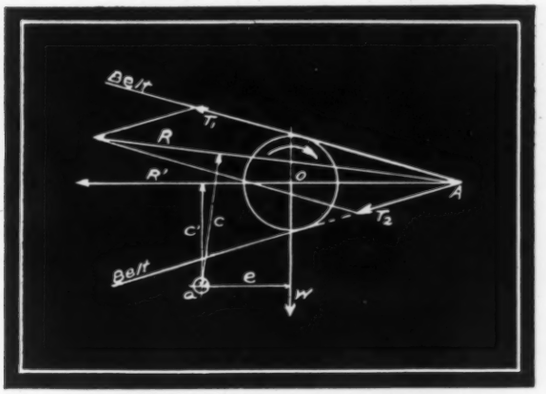


Fig. 2—Sum of the tensions and hence the bearing pressure will decrease with increasing load, in certain cases

The form of equations (2), (3), (4) and (5) shows that if a, b, and k remain constant, each of the quantities T_1, T_2, T_1+T_2, and $T_1—T_2$ is a linear function of the load P. If these quantities are plotted against the load, their graphs will therefore all be straight lines, having slopes equal in each case to the coefficient of P, so that

Slope of T_1	$= bk/(a+b)$
Slope of T_2	$= -ak/(a+b)$
Slope of T_1+T_2	$= (b-a)k/(a+b)$
Slope of T_1-T_2	$= k$

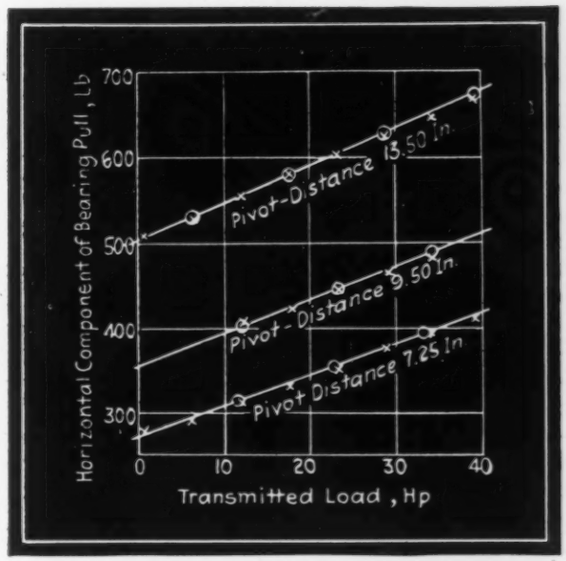


Fig. 3—These curves, obtained by means of a belt testing machine, furnish experimental confirmation of the validity of the belt tensions given by equations 3 and 4

These slopes involve only a, b, and k; k is always positive and is here assumed to be constant, which, while not usually strictly true, is nearly enough so for the present purpose; and a and b are positive when the pivot lies outside the angle between the belt strands. If, however, the pivot lies between the strands, either a or b is negative, accordingly as the lower strand is the tight or the slack one, because of the reversal of sign of the corresponding moment.

In general: When the pivot lies outside the belt strands, so that a and b are both positive

Slope of T_1 is + and T_1 increases with the load
Slope of T_2 is — and T_2 decreases with the load
Slope of $T_1 + T_2$ is + if $b > a$; i.e., tight strand next to pivot; and — if $b < a$; i.e., slack strand next to pivot

When the pivot lies inside the belt angle

If b is — and $< a$, (T_1 above), slopes of T_1 and T_2 are both —
If a is — and $< b$, (T_1 below), slopes of T_1 and T_2 are both +

Thus in certain cases the sum of the tensions, and hence the bearing pressure, will decrease with increasing load.

The explanation of this apparent anomaly will appear from *Fig.* 2, in which the belt pulls T_1 and T_2 are drawn from their meeting point A, the tight strand in this case being above. Since T_1 is greater than T_2 their resultant R necessarily passes above the center of the motor pulley O. The moments of T_1 and T_2 about the pivot Q

may be replaced by the moment of their resultant. This has the value RC, and it is equal and opposite to eW, the moment of motor weight, since there are no other moments. At zero load, T_1 and T_2 are equal, and their resultant R' passes through O. RC and $R'C'$ are each equal and opposite to the constant moment eW. Hence $RC=R'C'$, and since C is greater than C', R must be less than R', or the bearing pressure is less when the motor is loaded than when it is idling.

The effect of reduced belt tension when the tight strand is on the far side from the pivot may also be considered from another point of view. The so-called "torque reaction" of the motor, as affecting pivoted-motor drives, has been much discussed, and not always with full understanding, so that it may be well to consider briefly its bearing on the problem.

Imagine a motor hung like a pendulum, with its shaft horizontal, and at first let it be not belted or otherwise loaded. Let the current be switched on so as to cause an initial acceleration, say in a clockwise sense. The counter-clockwise reaction of the stator will then exert at the point of suspension an instantaneous

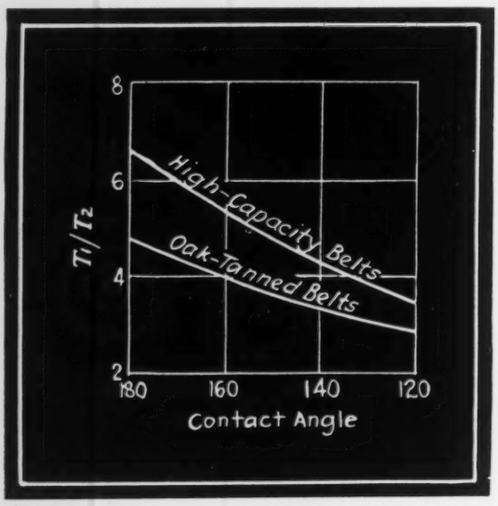


Fig. 4—Curves plotted from results of tests, give tension ratio in terms of contact angle

force toward the left. The system will therefore experience an external force applied at the point of suspension and directed toward the right, as a result of which the center of gravity of the motor will start to move toward the right. Hence there will be an initial counter-clockwise rotation of the motor as a whole, about the point of suspension. This is purely an effect of acceleration. As constant speed is approached, the deflection will drop to its initial or zero position.

In order to maintain a constant deflection it would be necessary to apply a constant external torque to the motor system, as, for example, by attaching fan blades to the motor shaft. At constant speed the system would then assume a constant deflection such as to bring about equilibrium between the torque due to air resistance and the gravitational moment due to weight.

Passing now to the belted motor, the fan torque is replaced by the torque due to tension difference in the belt strands. As a result of motor torque, a two-fold effect is produced: First, a tension difference due to the torque of the rotor, and second an overall tension, which may be attributed to the reaction of the stator, and which is an increase when the tight strand

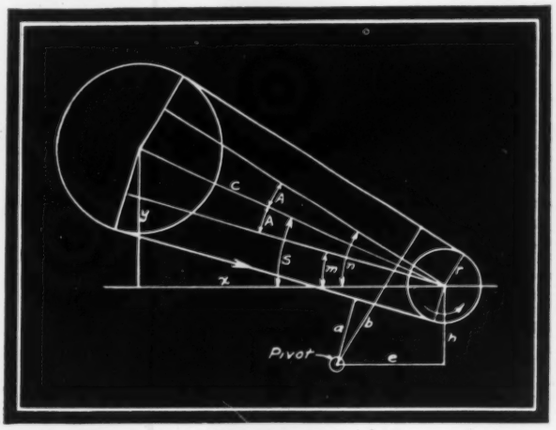


Fig. 5—Diagram showing lever arms of belt pulls about the pivot

is next the pivot, and a decrease when it is on the far side.

But—and this is important—having, in the derivation of formulas for the tensions, introduced the motor torque in terms of horsepower and speed as by the factors P and k in equations (3) and (4), the motor torque itself must then be forgotten, and is now represented by the changes in tension which it has produced and which would not exist without it.

Design of Pivoted-Motor Drive

The most direct approach to the problem of design appears to be through the tension ratio. Following this plan, the design of a particular drive to insure satisfactory performance under the given conditions will consist of two steps. First, a suitable value for the tension ratio must be decided upon. This will depend on the coefficient of friction between belt and pulley and on the contact angle on the smaller pulley. The second step is to calculate what position of the pivot with respect to the motor will produce the desired tension ratio.

The tension difference T_1—T_2 being fixed by the given horsepower and belt speed, it follows that a low value of T_1/T_2 corresponds to a high total tension, accompanied by good frictional grip of the belt on the pulleys, but with the danger, when carried too far, of shortened belt

(*Continued on Page* 56)

New Machines Indicate Design Trends

CONTRAST between design of today and that of only a few years ago is clearly revealed by the parade of new machines that has passed through this feature section. As indicated by the photographs and the summaries of design of these machines, progress has been due primarily to wise selection of materials and parts. Alert engineers have realized that every detail, even to the proper type of screw, must be given serious consideration. Screws of the hollow head type, for example, have assisted greatly in carrying out the trim or so-called streamline appearance that now, and for years to come, will hold ranking position in developing new machinery.

Machines recently announced in addition to those on the next two pages include the following, arranged by fields of application:

Air Conditioning

Portable Unit,
York Ice Machinery Corp.,
York, Penna.

Cooler and Dehumidifier,
Ilg Electric Ventilating Co.,
Chicago.

Self-Contained Unit,
Airtemp Inc.,
New York.

Agricultural

Power Mower,
Whirlwind Lawn Mowers Sales Corp.,
Milwaukee.

Bakery

Flour Sifter,
L. Burmeister Co.,
Milwaukee.

Business

Cash Register,
Ohmer Register Co.,
Dayton, O.

Ceramic

Radiant Tube Decorating Kiln,
Surface Combustion Co.,
Toledo, O.

Roll Crusher,
Pioneer Gravel Equipment Mfg. Co.,
Minneapolis.

Construction

Cement Batcher,
Richardson Scale Co.,
Clifton, N. J.

Convertible Excavator,
American Hoist & Derrick Co.,
St. Paul.

Bulk Cement Carrier,
Fruehauf Trailer Co.,
Detroit.

Concrete Vibrator,
Concrete Surfacing Machinery Co.,
Cincinnati.

Paver,
Ransome Concrete Machinery Co.,
Dunnellen, N. J.

Dental

Denture-Forming Unit,
Hanau Engineering Co.,
Buffalo.

Entertainment

Motion Picture Projector,
Bell & Howell Co.,
Chicago.

Foundry

Sand Washer,
Harry W. Dietert Co.,
Detroit.

Industrial

Powergun Lubricator,
Alemite Corp.,
Chicago.

Sand Dewatering Device,
Link-Belt Co.,
Chicago.

Two-Stage Stationary Compressor,
Schramm Inc.,
West Chester, Pa.

Three-Motor Crane,
Harnischfeger Corp.,
Milwaukee.

Diesel Engine,
Murphy Diesel Co. Ltd.,
Milwaukee.

Heavy-Duty Pulsator,
Smith Engineering Works,
Milwaukee.

Metalworking

General Purpose Turret Lathe,
International Machine Tool Co.,
Indianapolis.

Vertical Grinder,
Niles Tool Works Co.,
Hamilton, O.

Gun Welder,
Thomson-Gibb Electric Welding Co.,
Lynn, Mass.

Drum Grinder,
Diamond Machine Co.,
Providence, R. I.

Pipe Threading Machine,
Landis Machine Co.,
Waynesboro, Penna.

Painting

Striping Gun,
De Vilbiss Co.,
Toledo, O.

Portable Spray Unit,
Decora Mfg. Co. Inc.,
Oakland, Calif.

Petroleum

Chilling Machine,
Carbondale Machine Corp.,
Harrison, N. J.

Railroad

Tie Tamper,
Barco Mfg. Co.,
Chicago.

Rubber

Tire Bead Wrapping Machine,
Terkelsen Machine Co.,
Boston.

Single Tube Vulcanizer,
Summit Mold & Machine Co.,
Akron, O.

Latex Spray Gun,
Burning Brand Co.,
Chicago.

Textile

Five-Color Universal Ribber,
Fidelity Machine Co.,
Philadelphia.

Color Matching Machine,
M-R-H Laboratories,
Dowagiac, Mich.

Elastic Yarn Tester,
Henry L. Scott Co.,
Providence, R. I.

Automatic Loom,
Draper Corp.,
Hopedale, Mass.

Card Clothing Tension Machine,
Davis & Furber Machine Co.,
North Andover, Mass.

Weighing

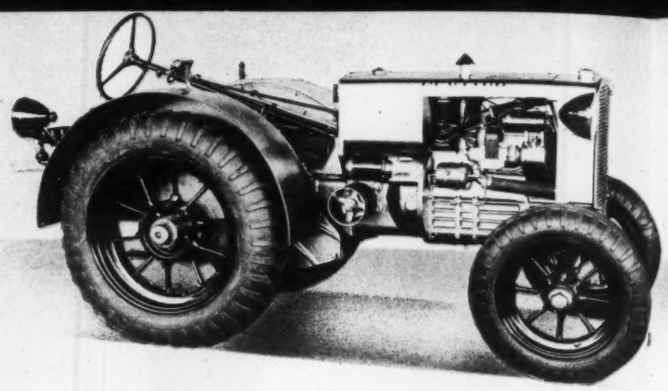
Conveying and Weighing Machine,
Richardson Scale Co.,
Clifton, N. J.

Woodworking

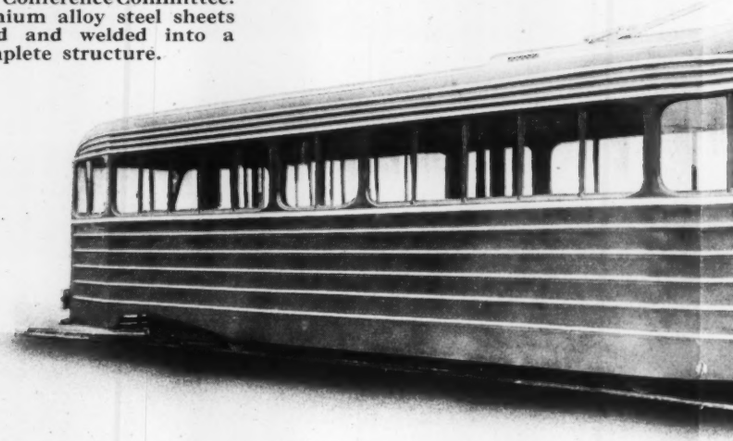
Chair Post Press,
Onsrud Machine Works,
Chicago.

Single Surfacer,
Oliver Machinery Co.,
Grand Rapids, Mich.

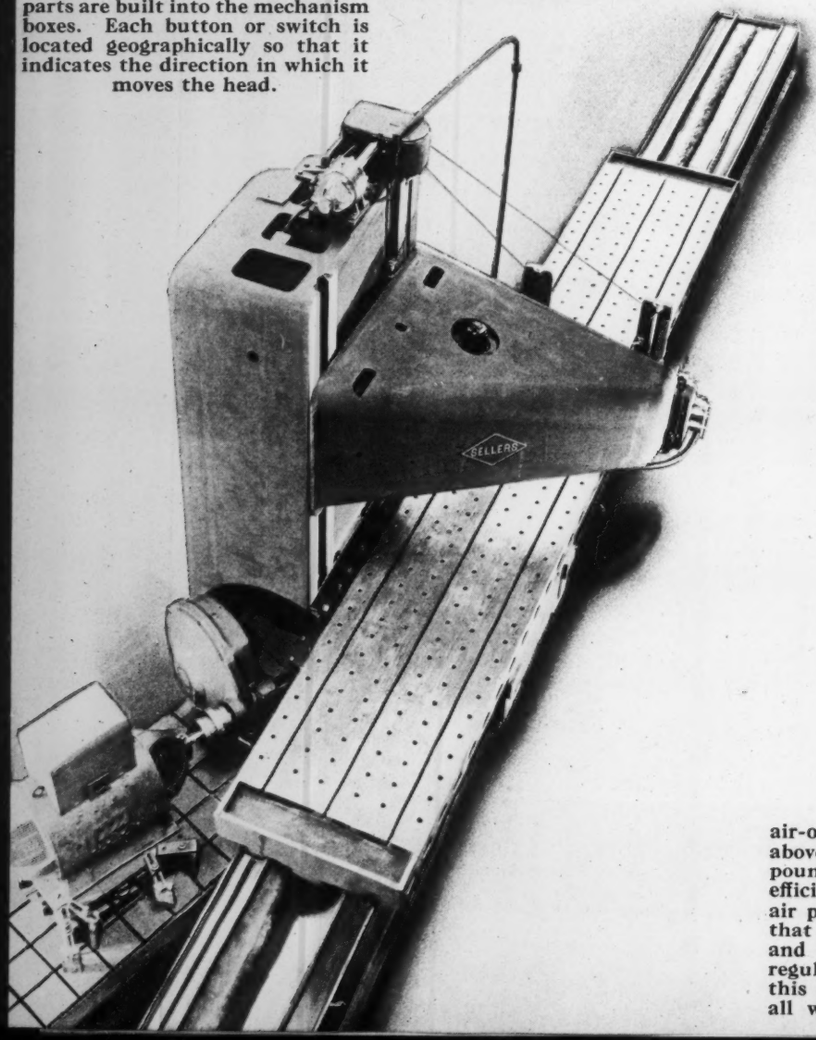
LIFTING mechanism embodied in the design of this Baker-Raulang mobile scoop truck first tilts the bucket back into carrying position and then raises it vertically to the desired height. The bucket is fabricated of ¼-inch steel plate, formed to shape and electrically welded. A wearing plate of chrome manganese steel is employed.



ARC WELDED alloy steel construction has produced a revolutionary street car, below, that is light, fast and quiet in operation. The unit, weighing 10,000 to 20,000 pounds less than conventional types, has been developed by the Electric Railways Presidents' Conference Committee. Low chromium alloy steel sheets are formed and welded into a complete structure.



ONE of the novel design features of the new Sellers openside planer, below, is the simplification of the feed and traverse mechanism by means of electrical apparatus. All electrical parts are built into the mechanism boxes. Each button or switch is located geographically so that it indicates the direction in which it moves the head.



Design in New

A Pictorial Presen from the S

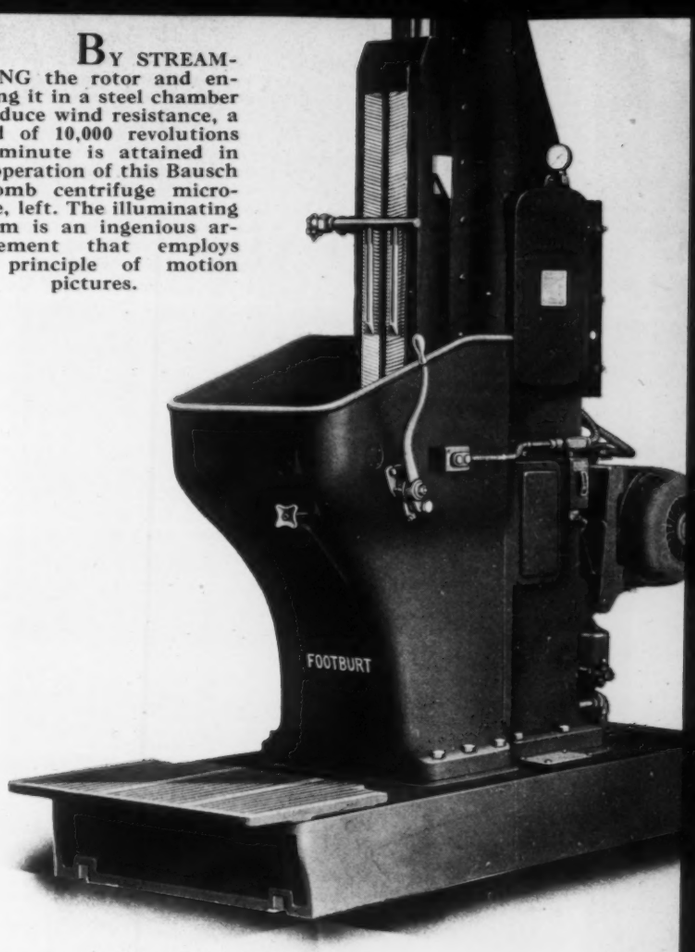
HIGH PRESSURE, air-operated Alemite barrel pump, above, converts any original 100-pound lubricant container into an efficient power gun. It boosts the air pressure to thirty-three times that of the pressure supply line, and pumps eighteen ounces of regular lubricant a minute. In this maroon, chrome-plated unit all working parts are accessible.

ign Features ew Machines

l Presentation of Recent Machinery n the Standpoint of Design.

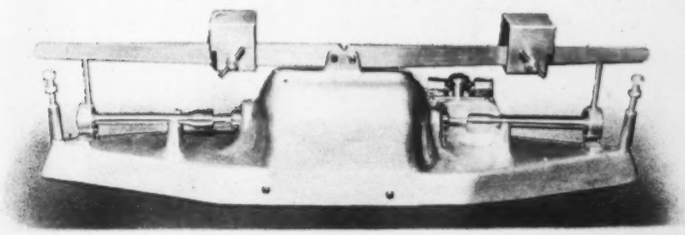
A 16-inch clearance under the Centaur tractor, left, has been accomplished without increasing the overall height of the machine. Built-in flexible lift eliminates necessity for special or accessory lifts. Pneumatic tires, individual rear wheel brakes equalized for transportation, and engine and transmission castings of nickel iron are other design features.

BY STREAMLINING the rotor and enclosing it in a steel chamber to reduce wind resistance, a speed of 10,000 revolutions per minute is attained in the operation of this Bausch & Lomb centrifuge microscope, left. The illuminating system is an ingenious arrangement that employs the principle of motion pictures.

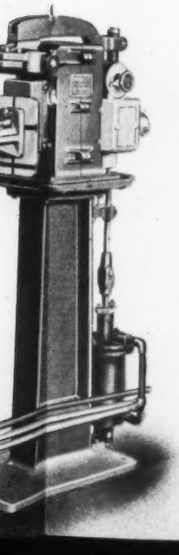


DESIGN of the new Foote-Burt single slide vertical surface broaching unit, right, incorporates hydraulic control. Base of the machine forms a large coolant tank, baffle plates being used to arrest all chips before coolant enters pump compartment. Pump drive shaft bearings and broach slide are lubricated automatically from the hydraulic system.

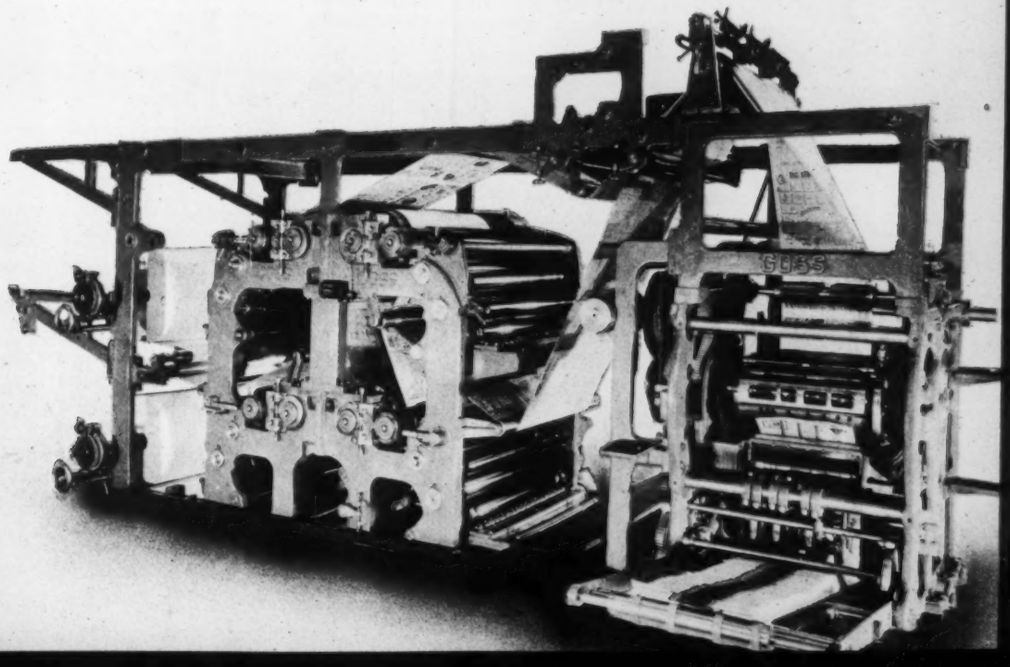
THE KROUSE high speed repeated-stress machine, below, for determining endurance limits of metals, handles two independent specimens. These are stressed as rotating cantilever beams, and are driven by a direct connected motor at 10,000 revolutions per minute.



IN ADDITION to the use of Timken bearings to eliminate play in the cylinders, this Goss printing press, below, embodies a new type of stereo plate which hugs the cylinder at all points. Two lugs on the inner edge of each plate are gripped firmly by a single lock-up device that holds the plates in positive tension, butted together at the center of the solid steel plate cylinder.



AIR PRESSURE is utilized for closing the electrodes upon the work in the Eisler electric spot welder, left. By actuating a foot-controlled valve, air acts on a piston which imparts motion to the electrode through a vertical drive shaft. A regulating valve controls the pressure on the work.



Neglected Elements of Recovery Becoming More Apparent

WITH ten million people still unemployed and billions of dollars being spent in relief work, the question of prices and production in relation to "supply and demand" still confronts us. As pointed out recently by Dr. Ralph E. Flanders, one of the few outstanding engineers who has interested himself deeply in economics and politics, we are faced with the inherent difficulty of prices being raised in advance of demand for goods! It is his contention that complete recovery can only be brought about by the lowering of prices and consequent increase in production and consumption.

The same authority draws attention to other factors that logically may be assumed to have retarded recovery: Short-lived advantages of devaluation; loss of foreign markets due to high prices; taxation of industry to the benefit of agriculture; reduction in profits militating against industrial expansion; too-short working hours; overwhelming government expenditures.

Far too many engineers have in the past failed to recognize that such factors vitally concern them, as well as the nation as a whole. An apathetic feeling has existed toward matters political, social or economic. But the time has come when this condition necessarily must change. Fortunately there already are signs that this is happening.

Assuming that all, or most, of us now realize that we never have actually reached a "saturation point" in manufactured products and that higher speed machinery still is inimicable to recovery, it will be a tremendous asset when we also recognize that it will pay in future to devote at least a portion of our time to taking a more active part in governmental and other agencies affecting our everyday life.

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Whirling Centrifuges!

OF THE relatively new machines destined to play a large part in the future, the centrifuge seems to be among the foremost. Chemists in particular continually are putting centrifugals to wider use, even to the extent—as one recently asserted—to whirling out the "morning after" impurities from whiskey!

This may be of great benefit to many, but to the practising scientist and engineer the centrifuge has even more important functions. Speeds of fifty thousand revolutions per minute are not uncommon, while as high as 1,200,000 have been reached experimentally.

In the separation of liquids or solids, the testing of structures through substitution of centrifugal force for gravity, or for other uses not yet fully developed, the centrifuge holds out great possibilities.

PROFESSIONAL VIEWPOINTS

Machine Design Welcomes Letters Suitable for Publication

Every Copy Thoroughly Enjoyed

To the Editor:

I HAVE just run across your magazine MACHINE DESIGN, thanks to Mr. George Bemis, manager of the El Paso Foundry & Machine Co., who loaned me a copy some weeks ago. It didn't take me long to find out that this was the very magazine I'd been looking for over some years past.

I am really sincere in what I have just said, and will add that Mr. Bemis, after having learned that I liked MACHINE DESIGN, loaned me the twelve copies he received in the year 1934, which very nearly caused me to lose a whole night's sleep. Every copy was thoroughly enjoyed, though, and to prove it I am mailing an order for a year's subscription. Will you kindly send me a copy of the February, 1935, issue immediately, as I have been unable to procure it here?

—H. D. TISDALE
El Paso, Texas

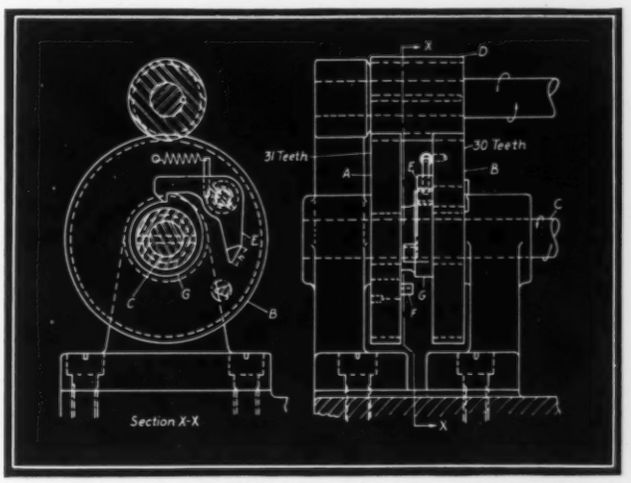
Pitch Variation Gives Dwell

To the Editor:

YOUR readers may be able to utilize the idea embodied in the following: In a certain can labeling machine a number of cans are carried along on an endless chain conveyor to a position where the labels are applied. The conveyor, which dwells at this point, receives its motion from latch-actuated intermittent gears like those shown in *Fig.* 1. This arrangement consists chiefly of gears *A* and *B* which are provided with bronze bushings and turn on the driven shaft *C*. Gear *A* has 31 teeth while gear *B* has one tooth less.

In order to permit the same pinion gear *D* to drive both gears, it was necessary to make them with the same outside diameter and to cut the teeth in one slightly deeper than in the other. In this way the teeth in both gears have the same thickness. This did not affect the operation of the gears since an involute tooth form is used.

Both gears *A* and *B* are driven at a constant velocity by pinion gear *D*. On one side of gear *B* is pivoted latch *E* which when tripped at *h* by pin *F* in gear *A*, is disengaged from the projection on ring *G* pinned to shaft *C*. Gear *A*, having an extra tooth, rotates slower than gear *B*; hence, if the gear *D* continues to turn in the direction indicated, the lower end of latch *E* will gradually approach pin *F*. When the latch comes into contact with the pin, the latter forces the hooked part of the latch out of engagement with the ring *G* allowing the ring and shaft *C* to dwell.



Dwell is accomplished every thirty revolutions by variation of one tooth in gears

This dwell continues until pin *F* passes over the latch surface *h*. When the pin leaves this surface, the latch is swung back into engagement with ring *G* by the coil spring. In this case, the duration of the dwell is equivalent to two complete revolutions of gear *B*, and occurs after every 28 revolutions of shaft *C*. This is evident as gear *A* lags one tooth for each revolution of gear *B*. Therefore, it takes 30 revolutions of gear *B* to complete one revolution of pin *F* relative to latch *E*. By modifying the gear ratios and the length *h* on the latch various intermittent movements can be obtained for applications of a similar nature.

Overrun of shaft *C* may be prevented by equipping this member with an ordinary stationary band brake held snugly around a drum attached to the shaft by a suitable spring. For the installation under discussion the brake was not required as the conveyor itself developed ample friction to prevent overrun.

—J. E. FENNO
Belleville, N. J.

Assets to a Bookcase

Marketing Industrial Equipment

By Bernard Lester; published by McGraw-Hill Book Co. Inc., New York; available through Machine Design *for* $3.50 *plus* 15 *cents postage.*

With the rising importance of marketing problems as a vital influence on the design of machinery, it has become imperative that the designer apprise himself of such factors. Books like this one will go far in clarifying the situation for engineers. The author, as assistant industrial sales manager of Westinghouse, is well qualified to discuss the marketing of industrial equipment.

Significant is the fact this is the first book to be published on the subject. Because the approach to the problem of selling must change with the altered conditions in industry, design will be much in the limelight. In these times the treasurer or financial head of the purchasing company has a more vital interest in determining the outlay for new machinery and equipment. He must be shown that for a definite allotment of funds there will be a definite return, and that this return must pay for the outlay in a specific and relatively short period even when the plant operates on a restricted schedule as to volume of production.

In discussing his subject Mr. Lester declares that great progress in economical and controlled distribution will come through a popular realization of the folly of price selling and price buying. The book deals specifically with methods of market and product analyses, principles involved in economic distribution, and the organization and operation of the sales department and sales outlets.

□ □ □

Industrial Standardization, Its Principles and Application

By John Gaillard; published by H. W. Wilson Co., New York; available through Machine Design *for* $2.00 *plus* 15 *cents postage.*

More thought is being given to standardization, as indicated by the increased activity of individuals and companies. Evidence collected by the author of this book shows, however, that the degree to which industrial standardization has been adopted by manufacturing establishments as a systematically applied managerial function represents only a small fraction of what might be expected in view of the benefit that may be derived from its application.

The designer will find valuable information on the four major phases in which standardization work may be carried out, namely, within the company, by trade association or technical society, under the procedure of a national standardizing body, and on an international scale. Particularly interesting are Mr. Gaillard's studies on essential functions of industrial standardization, the definition and characteristics of a standard, normal values and limits, and development of the practical application of standardization work. A chapter dealing with the standardization of a manufacturing concern stresses the problem of co-ordinating different activities which permit the formulation of certain principles to be observed in organization and in carrying out industrial standardization in practice.

□ □ □

Applied Descriptive Geometry

By Frank M. Warner; published by McGraw-Hill Book Co. Inc., New York; available through Machine Design *for* $2.25 *plus* 15 *cents postage.*

This book will serve primarily those who require training or review of fundamentals. However, the author declares that it is not intended to be a text on descriptive geometry, even though it reproduces necessarily most of the material ordinarily included in that subject. The chief objective in offering this text to the profession is to place major emphasis on the application of principles that long have been well known.

The method followed in the book is to start the reader out with simple three-view orthographic projection. Then he is required to draw other objects for which he will see the necessity of knowing how to draw any kind of an auxiliary view. Subsequently the ordinary point-line-plane problems are introduced.

Because the author believes that the usefulness and practicability of this subject in many cases is obscured by failure to relate its principles to actual engineering experience and methods of the drafting room, he took particular caution in assembling his text to establish a keen interest on the part of readers by embodying problems with a practical aspect.

MEN OF MACHINES

WITH a background of experience particularly adaptable to his chosen field, M. L. Eckman now heads the research and development department of Thomson-Gibb Electric Welding Co. For the past five years he has been research and development engineer for Federal Machine & Welder Co.

Born in Butler, Pa., in 1895, Mr. Eckman early served a machinist's apprenticeship. At the conclusion of this period he accepted a position with Engineers & Foundrymen's Laboratories in Pittsburgh and took an engineering course at Carnegie Tech.

Moving to Detroit, Mr. Eckman after various affiliations went with Ford Motor Co. There he was foreman in charge of the machine construction department, and later supervisor of welding. Subsequently he joined Taylor-Winfield Corp.

M. L. ECKMAN

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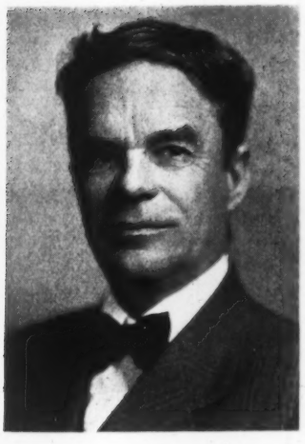


FOR his outstanding contributions to the development of electric clocks and of means for controlling central station frequencies. Henry E. Warren has been awarded the A.I.E.E. Lamme medal. He is president of the Warren Telechron Co.

Born in Boston, May 21, 1872, Mr. Warren was graduated from Massachusetts Institute of Technology in 1894. In 1907 he settled in Ashland, Mass., and spent considerable time in designing electric clocks as an avocation. The sequel to his experiments was the organization of Warren Clock Co. in 1912.

Mr. Warren since 1916 has been engaged in adapting timekeeping synchronous motors to many fields and in developing devices for frequency control. More than one hundred patents have been granted to him.

H. E. WARREN

• • •

THE manager of the machinery division of Pratt & Whitney Co. now is Hubert D. Tanner, appointment having been made recently. He has served this company continuously since 1920 when he joined it as an engineer; during part of this time he did extensive sales engineering work. More recently he has been in charge of the development of gear grinding machines.

Mr. Tanner was born in Pawtucket, R. I., educated in mechanical engineering at Brown university and also attended the Rhode Island School of Design. For eight years he was an engineer in both machine and tool designing for Brown & Sharpe Mfg. Co.

His work has taken him into many plants in both this country and abroad and he is well known in the automotive industry

H. D. TANNER

through his work in connection with automobile transmission gearing. Technical societies with which Mr. Tanner is affiliated include the American Society of Mechanical Engineers, Society of Automotive Engineers and the American Gear Manufacturers association.

* * *

G. W. Brucker now is a designing engineer in the power rectifier engineering department of General Electric Co.

* * *

Carlos M. Heath recently was appointed assistant metallurgist on the staff of Battelle Memorial institute.

* * *

S. A. Jeffries has been appointed chief engineer of Stutz Motor Car Co.

* * *

Horace T. Thomas, one time vice president, director and chief engineer of Reo Motor Car Co., retired from the organization on March 1.

* * *

Russell G. Thompson, formerly general manager, electromatic typewriters division of International Business Machines Corp., has joined the Underwood, Elliott, Fisher Co. as a member of the engineering staff.

* * *

Francis F. Lucas, in charge of the microscopical laboratory at Bell Telephone Laboratories Inc., has been awarded the John Price Wetherell medal by Franklin Institute in consideration of his development of a technique of microscopy and photomicrography.

* * *

Dr. Arthur D. Little has retired as president of Arthur D. Little Inc. His successor is Earl P. Stevenson who has been a member of the organization since 1919 and vice president and director of research since 1922. Dr. Little continues his affiliation with the organization as chairman of the board.

* * *

Prof. Albert Portevin has been awarded the Bessemer gold medal of the British Iron and Steel institute. He is director of Institut de Soudre Autogene and professor at the Ecole Centrale des Arts et Manufactures and the Ecole Auperiore de Fonderie in Paris, France.

* * *

John R. Tillman, for the past number of years head of tool engineering for the Bullard Co., recently was appointed assistant to Dudley B. Bullard, vice president in charge of engineering. His new capacity as chief executive engineer combines the supervision of all departments of engineering.

* * *

August Kayser, designer at the Fort Wayne works of General Electric, has been presented with the Coffin award in recognition of his skill and ingenuity in redesigning the winding arbor of an automatic machine for the internal winding of motor stators.

* * *

George C. Stone, formerly with the New Jersey Zinc Co., recently received the James Douglas medal of the American Institute of Mining and Metallurgical Engineers for service in the field of nonferrous metallurgy. Francis M. Rich, Republic Steel Corp., was awarded the J. E. Johnson medal which is given annually to the engineer under thirty-five years of age who has distinguished himself in iron and steel work.

* * *

P. A. Celender, has severed his connection with Williams Oil-O-Matic Heating Corp., and now is in charge of product engineering for the Herman Nelson Corp., Moline, Ill.

* * *

Erle G. Hill has joined the Lukens Steel Co. as director of research. Previously he was engaged in research work at Mellon Institute of Industrial Research where he held a research fellowship.

* * *

Dr. Paul D. Merica has been elected vice president of the American Institute of Mining and Metallurgical Engineers. He is a recognized authority on nickel, copper and other alloys and is assistant to the president, International Nickel Co.

* * *

Charles J. Thomas recently was appointed secretary-manager of the Cleveland Engineering society, succeeding Carlton R. Sabin who resigned to enter the commercial field.

* * *

Oliver F. Redd has joined the research department of Patterson Foundry & Machine Co. For several years he has been engaged in development work in the laboratories of the Bell Telephone Co.

* * *

William T. Shaler has joined the Ajax Flexible Coupling Co., Westfield, N. Y., as engineer in charge of the development of machinery for screening and separating grain, sand, etc. He was formerly affiliated with S. Howes Co.

* * *

Dr. Elihu Thomson on the occasion of his eighty-second birthday on March 29, was awarded the medal of honor of Verein Deutscher Ingenieure, the outstanding award of the German engineering profession.

* * *

Arthur S. Tuttle recently was elected president of the American Society of Civil Engineers.

Obituaries

Frank L. Morse, president of the Morse Chain Co., died recently at the age of 70 at Orlando, Fla. He with his brother founded the Morse company and until four years ago was active in its development and progress.

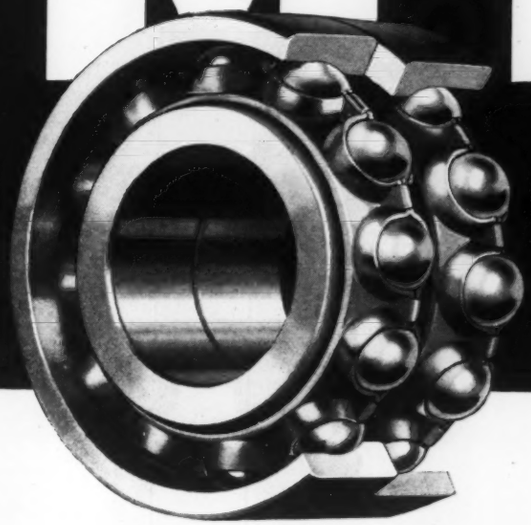
* * *

Charles L. Lee, inventor of automotive appliances and also active in the development of early electric refrigeration, and for many years a close associate of Charles F. Kettering, died in Dayton, O., recently.

Leadership

GURNEY SRB STROM

M-R-C



M-R-C
Duplex
BALL BEARINGS

13 YEARS WITHOUT ADJUSTMENT

M-R-C Preloaded Duplex bearings made possible this unusual record of spindle service on six turret lathes. They ran continuously . . . some day and night . . . working to limits of .001″ on very hard service for 13 years without adjustment. Preloaded M-R-C Duplex bearings are unsurpassed for obtaining permanent spindle rigidity.

M-R-C Strom SRB Gurney Ball Bearings

MARLIN-ROCKWELL CORPORATION
Executive Offices—JAMESTOWN, N. Y.
Factories: Jamestown—Plainville, Conn.—Chicago

M-R-C BALL BEARINGS
GURNEY • SRB • STROM

TOPICS

POTENTIAL machinery requirements of all industry total over $18,574,000,000. The survey by which this tremendous pending market has been determined was instigated by the Machinery and Allied Products Institute. Of this huge sum machine tool requirements are valued at over $724,410,000; electrical machinery, apparatus, etc., over $6,060,000,000; agricultural implements over $731,840,000; engines, turbines, tractors and water wheels over $1,203,000,000; foundry and machine shop products over $7,299,000,000 and all other machinery over $2,554,000,000.

One of the illuminating features of the Institute's survey is that pertaining to potential machine requirements of builders of machinery themselves. Total value of this is over $45,377,000 of which $31,150,000 is for machine tools; $3,332,000 for electrical equipment; $2,434,000 for handling and service; $2,511,000 for power plant and boilers, and $5,948,000 for other machinery.

* * *

They Like Our Mechanical Toys

Increase in the demand in foreign markets for American toys reflects the mechanical ingenuity that has been incorporated in their design. Shipments to such countries as England, South America, and South Africa have mounted steadily in the last six months.

* * *

Wants Research Centers Developed

In his annual report Harry E. Clifford, dean of Harvard engineering school, included a proposal for the development of outstanding research centers at the university in the fields of applied mechanics, sanitary engineering and high voltage, by expansion of the present laboratories and the addition of new ones. In recommending the development of a center for the study of applied mechanics Dean Clifford said: "There is at present no center in this country in which the whole field is being covered. Therefore an opportunity exists for a development at Harvard somewhat similar to that fostered by Prandtl at Goettingen, so inclusive and of such strength that it would attract the better graduate students and be the recognized training place for engineers, research workers and teachers in the field."

* * *

Machine Tool Gets Green Finish

The editor of Barber-Colman "Hobbing Notes" says he got an eyeful the other day when he passed the paint shop and saw a No. 3 hobbing machine being finished in bright apple green instead of the usual machine tool gray.

* * *

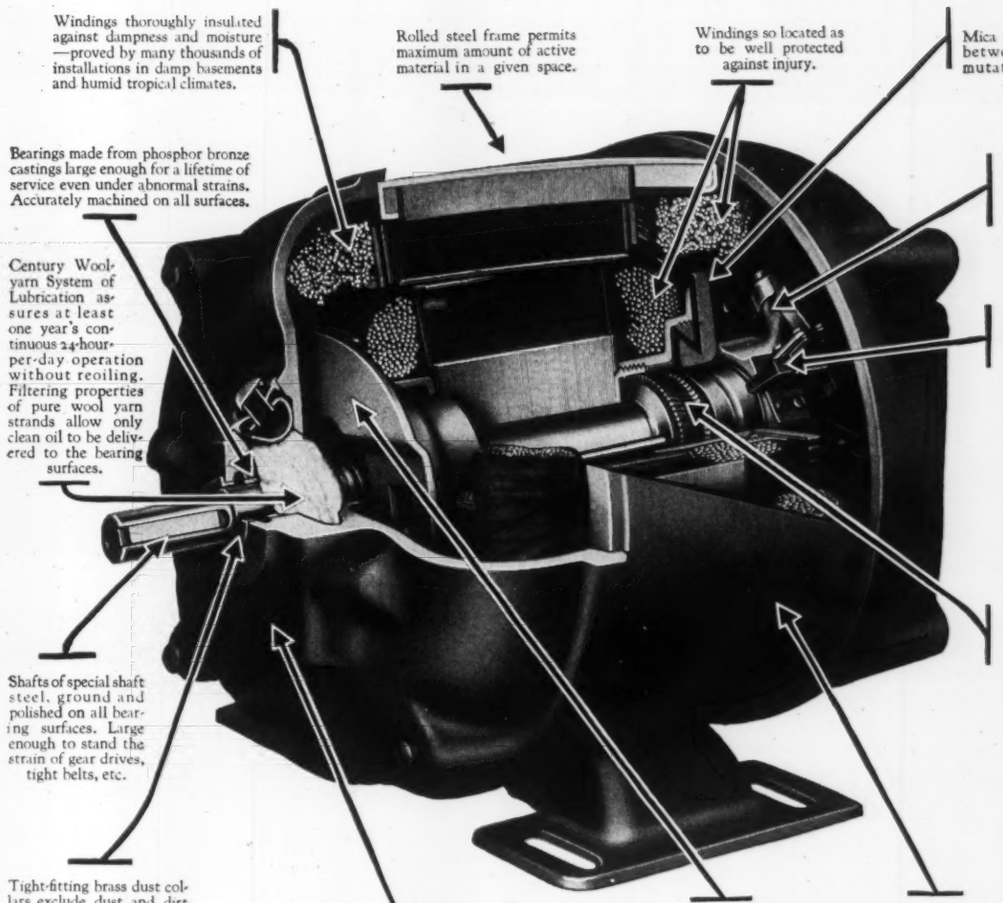
Diesel Hangs Up Another Record

Modern design adds new laurels to its achievements in the railroad field. The streamlined train operated by the Burlington road recently set a record in low fuel cost when it consumed only $43 worth of fuel oil for 2800 miles. Averaging approximately 1.5 cents a mile for fuel, the cost compares favorably with that of the average automobile.

* * *

Machine Shows Pictures in Relief

Word comes from Paris that Louis Lumiere, noted cinema pioneer, has designed apparatus for producing motion pictures in relief, so that life appears on the screen apparently in three dimensions. According to the *New York Times*, two images are projected, one predominantly yellowish-green and the other blue. The audi-


Windings thoroughly insulated against dampness and moisture —proved by many thousands of installations in damp basements and humid tropical climates.
Rolled steel frame permits maximum amount of active material in a given space.
Windings so located as to be well protected against injury.
Mica insulation between commutator bars.
Bearings made from phosphor bronze castings large enough for a lifetime of service even under abnormal strains. Accurately machined on all surfaces.
Brush holders made of brass — springs of phosphor bronze. Non-rusting.
Century Wool-yarn System of Lubrication assures at least one year's continuous 24-hour-per-day operation without reoiling. Filtering properties of pure wool yarn strands allow only clean oil to be delivered to the bearing surfaces.
Large area carbon brushes in service only during the starting period— in many classes of service, brushes are in contact with the commutator only 1/900th part of the time the motor is operating. This insures long life.
Copper short-circuiting segments so located as to be protected from dirt, oil or grease. Simultaneous sliding contact of all segments insured by positive governor operation which controls movement of the carrier in which segments are mounted.
Shafts of special shaft steel, ground and polished on all bearing surfaces. Large enough to stand the strain of gear drives, tight belts, etc.
Tight-fitting brass dust collars exclude dust and dirt from the oil well. They are as nearly dust tight as it is possible to build them and remain so throughout the life of the motor.
Extra large oil well. Holds sufficient oil for at least one year's continuous operation.
Positive acting governor device, of steel construction, rust-proof. Light weight. The "M" frame motor has been proved by more than 15 years commercial service and laboratory tests of over a million starts.
Black Lacquer finished frame.

The Inside Story of

CENTURY REPULSION START INDUCTION BRUSH LIFTING, SINGLE PHASE FRACTIONAL HORSE POWER MOTORS

Sold All Over the World

The things you never see in Century Single Phase Motors are those refinements of design and attention to every construction detail, which are responsible for their continuous performance in all types of installations requiring high-starting torque and low-starting current . . . This is the motor that has played such a conspicuous part in developing and popularizing the use of Household Refrigerators, Pumps, Oil Burners, Stokers and similar apparatus . . . Horizontal, Flange, Vertical, Cushion and Built-in Mountings . . . 1/8 to 40 Horse Power . . . Consult Century Engineers.

Century

CENTURY ELECTRIC COMPANY

1806 Pine Street , , , , St. Louis, Mo.

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MOTORS 1/250 TO 600 HORSE POWER

ence wears spectacles with correspondingly tinted lenses. Each eye picks out its own colored picture and the brain of the spectator combines the two into single brilliant black and white relief. The problem of relief, as old as photography itself, was solved many years ago by means of the stereoscope.

* * *

Streamlining Goes to College

Believed to be the first ever offered in an engineering college, a course covering basic aerodynamic and dynamic principles of streamlined trains and other high-speed railroad equipment will be introduced this fall at the Daniel Guggenheim School of Aeronautics in the college of engineering at New York university. The graduate school of the university will co-operate with the aeronautical school in sponsoring the course which will be one of a group leading to the degree of master of science in aeronautical engineering.

* * *

Priestley Envisioned the Electron

More than 150 years ago John Priestley, discoverer of oxygen, visualized the possibility of the existence of electrons. This fact was revealed in a little-known Priestley volume included in the exhibition of old chemical books at the Chemists club in New York. The exhibition was held in connection with the observance by the American Chemical society, April 22 to 26, of the tercentenary of the founding of the chemical industry in the United States.

* * *

Ford V-8 Uses 164 Pounds of Rubber

Quantity of rubber employed in Ford car construction has trebled in the past eight years. The model T contained only 56 pounds of rubber while the present V-8 utilizes 164 pounds. Company officials state that they would not be surprised to see as much as 200 pounds used in future Ford cars.

* * *

Machine Takes Skid Out of Tires

A machine to cut lateral slots automatically in the surface of automobile tires to reduce skidding recently came into the public eye. Three-sixteenths of an inch deep, one-sixteenth wide and a quarter of an inch apart, these slots are are cut entirely across the tread of the tire and around its circumference. Cutting of these slots does not harm the tire in any way, it is claimed. For the past two years British and French motorists have been cutting thin slots in the surface of their tires. The tiny slots produce a "Squeegee" effect on the road surface when the brakes are applied, that squeezes rain or snow out from between the road surface and the tread of the tire.

* * *

De-icing Planes in Another Way

A new method of preventing the formation of ice on the wings and propellers of airplanes is being developed by the application of an electrical resistance grid on the surface of the leading edge of the wings and propellers, according to V. A. Clarke writing in *New York Times*. The advantage of the resistance grid method, he says, is that the required heat can be applied readily by proper grid design to the narrow band along the leading edge where the initial ice formation takes place. Under this system no ice is formed, the crystals passing off as water.

* * *

New Enamels Show Promise

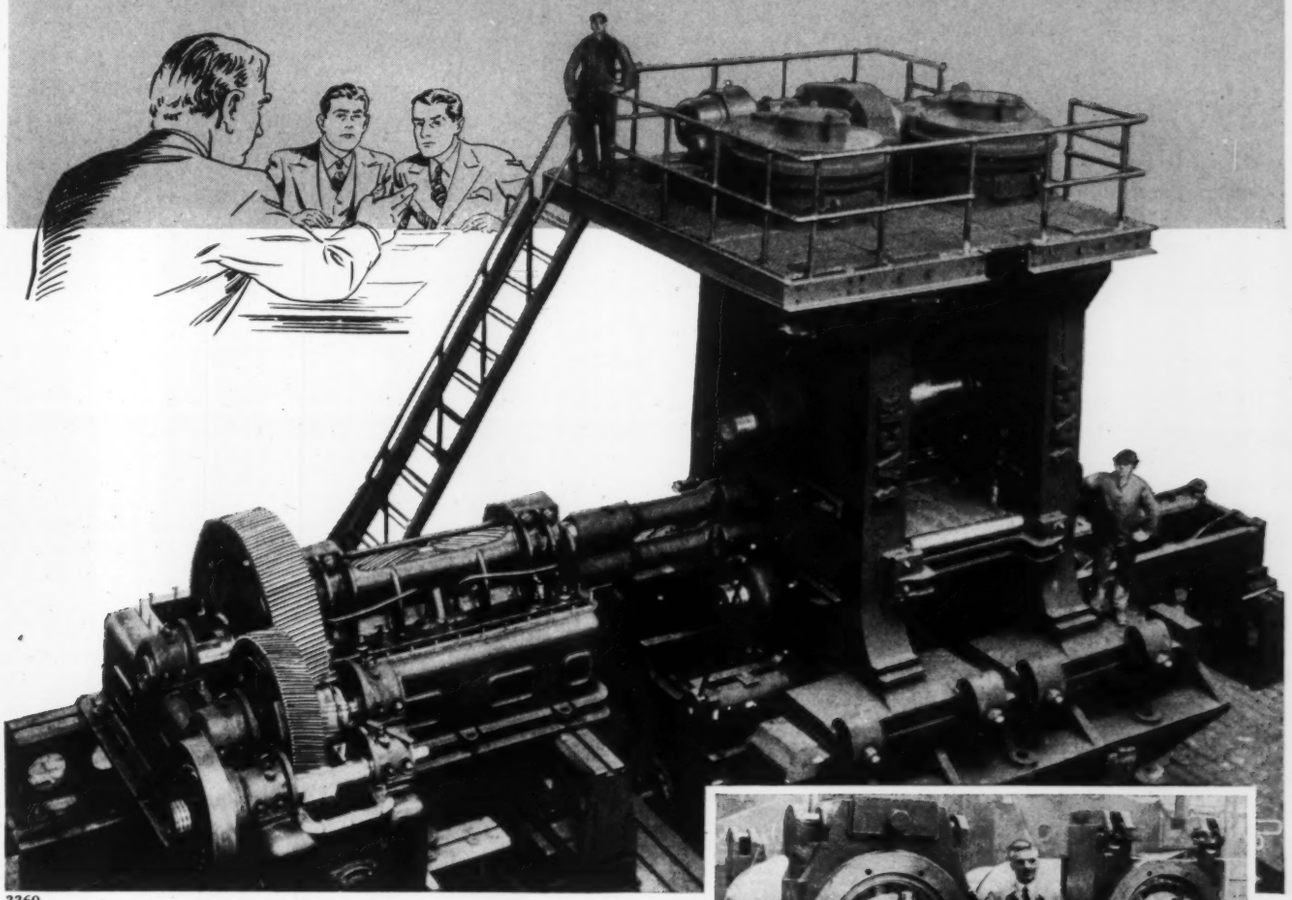
Porcelain enamels, handmaids of many good designs, contribute another product that promises exceptional possibilities. The new process was developed through the joint efforts of Dr. J. E. Rosenberg, director of research for O. Hommel Co., Pittsburgh, and William J. Baldwin, incumbent of the industrial fellowship established by the company at Mellon Institute. According to Dr. Edward R. Weidlein, director of the institute, the process achieves a greater degree of opacity and therefore depth of color in two coating and firings than are possible with three in present processes.

* * *

More Machine-Made Comfort

Air conditioning takes another move upward —the New York Central railroad recently announced that it is equipping 235 more passenger cars with air conditioning apparatus. The adoption of air conditioning by railroads is a significant factor in a modernization program that has lifted them from their lethargic state of a few years ago.

"It's a TOUGH JOB on bearings...better use SKF's"



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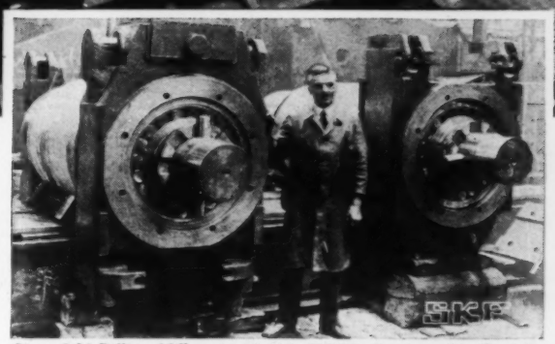


Giant Cold Rolling Mill equipped with SKF Bearings. It rolls stainless sheet steel under a load of 1,760,000 pounds. When you buy any machine or appliance, it pays to ask this simple question: "Is it SKF -equipped?"

SKF makes bearings that are as big as a car wheel or small as a dime . . . giant bearings for the big brute jobs of Industry . . . tiny bearings for delicate scientific instruments. Yet wide as is their range in size and use, all SKF Bearings are products of specialized anti-friction engineering that is recognized as standard throughout the world.

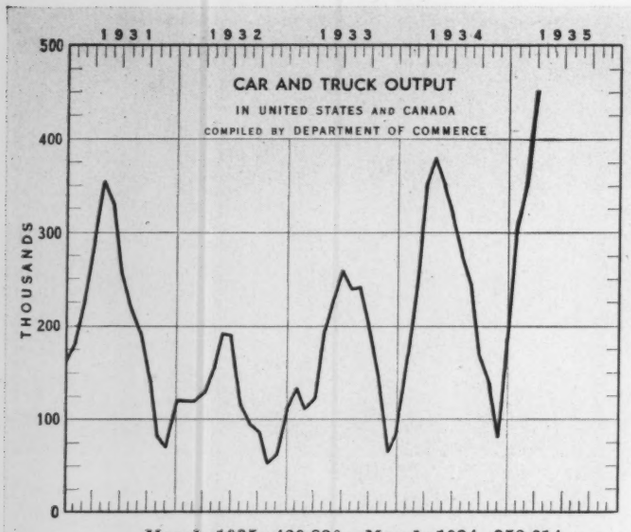
We take it as a tribute to this engineering that SKF Bearings are specified almost invariably for the big tough jobs of Industry.

We accept it as recognition of SKF quality that practically every outstanding bearing application for the past quarter of a century . . . airplane, dirigible, streamline train or industrial machine . . . has involved the use of SKF Anti-Friction Bearings.

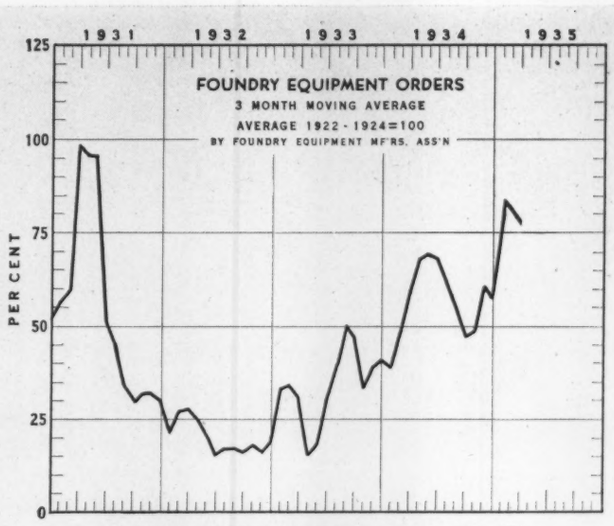
When a designer remembers SKF Bearings in the planning of a machine, the user can generally forget them during its life. SKF Industries Inc., Front St. and Erie Ave., Philadelphia, Pa.

SKF
BALL AND ROLLER BEARINGS

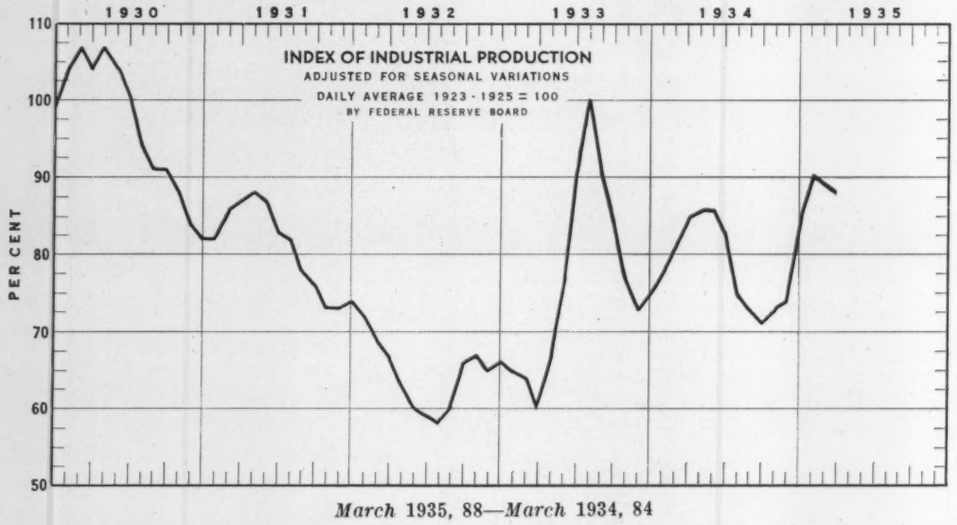
How Is Business?



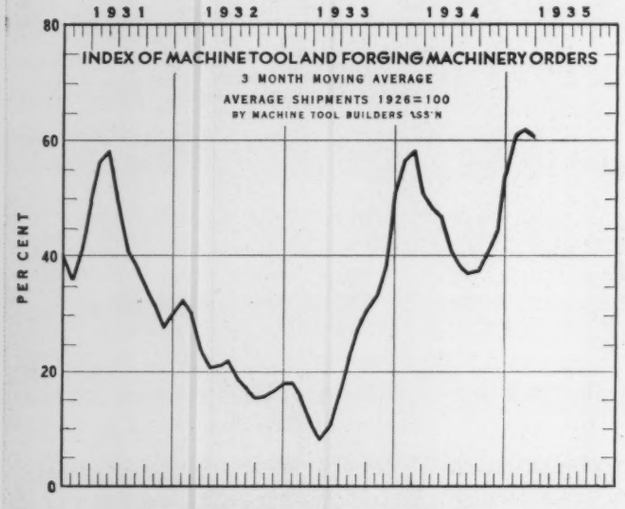
March 1935, 429.830—*March* 1934, 352,614



March 1935, 77.2—*March* 1934, 59.5

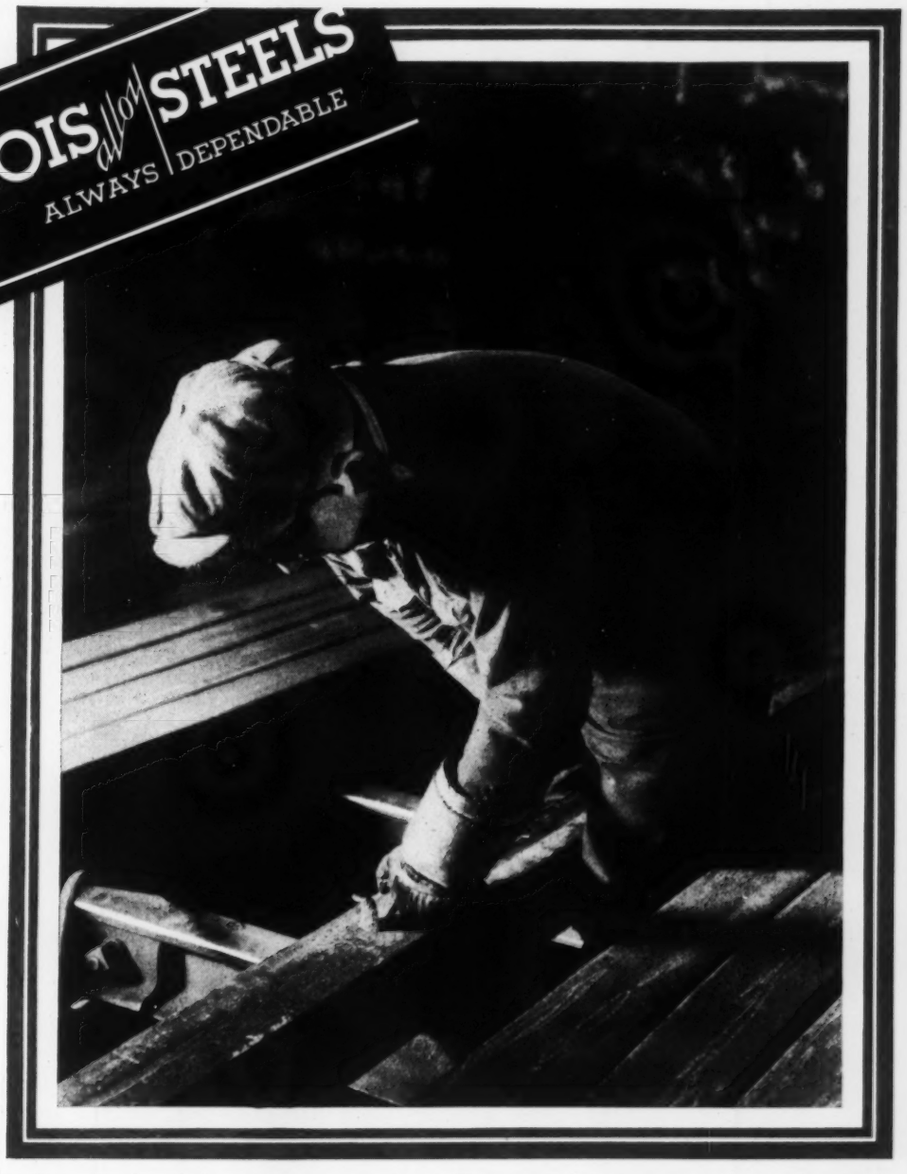


March 1935, 88—*March* 1934, 84



March 1935, 60.3—*March* 1934, 50.9

March 1935, 82.4—*March* 1934, 81.0



HOW AN OUNCE CAN SAVE A TON

● It's only a tiny seam . . . no larger than an eyelash . . . but out it comes before this billet of Illinois Alloy Steel can start through the mill. Every seam, every surface imperfection or irregularity is chipped out of the billets; and every billet is double-checked before going to the re-heating furnace. Thus, a few ounces chipped from a billet here safeguards the quality of the finished bar stock rolled from that billet.

Illinois' alloy mills are operated on the principle that quality in alloy demands the most exacting control of the mechanics of rolling as well as of the metallurgy of the steel itself.

From billet to shipping floor every step is subjected to rigid control and to relentless inspection. The result is an alloy bar free of physical defects or blemishes, straight as a die, finished to save costly operations in your own plant. We know of no mill practice more exacting or carrying greater assurance of quality steel.

ILLINOIS STEEL COMPANY

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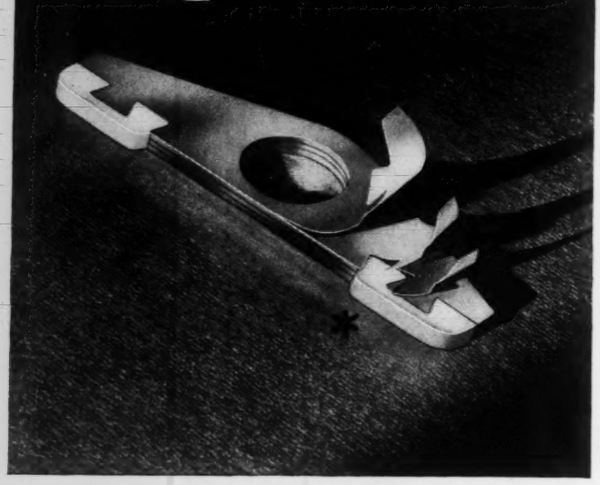
United States Steel Corporation Subsidiary

Correcting and holding bearing oil pressure



✻ OIL SEAL . . . PLUS PRECISION SERVICE ADJUSTMENTS! The soft babbitt tips stop bearing leakage and oil pressure loss . . . the laminated body of the shim provides the means for precision service adjustments of .002" or more. No filing . . . no miking. ● You simply p-e-e-l off one lamination or more for each adjustment! ● Adopted by leading bearing designers to correct oil pressure conditions and because they provide both (1) the practical economy of service adjustments and (2) the precision required by modern bearings. *Available with either .002 or .003" laminations. Sample on request.*

The solid shim that p-e-e-l-s for adjustment

LAMINUM

LAMINATED SHIM CO. 2126-44th Av., Long Island City, N. Y.
Cleveland Detroit Milwaukee

552

NOTEWORTHY PATENTS

SEVERING gobs of glass from a stream of semi-molten material is accomplished by a shearing machine, *Fig.* 1, invented by R. U. Adams and Clyde Hibbs for use with marble making equipment. Stream of glass 31 travels continuously through an aperture of the fixed

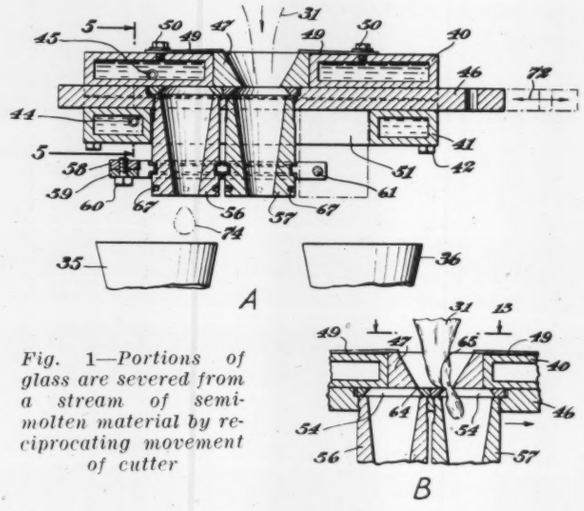
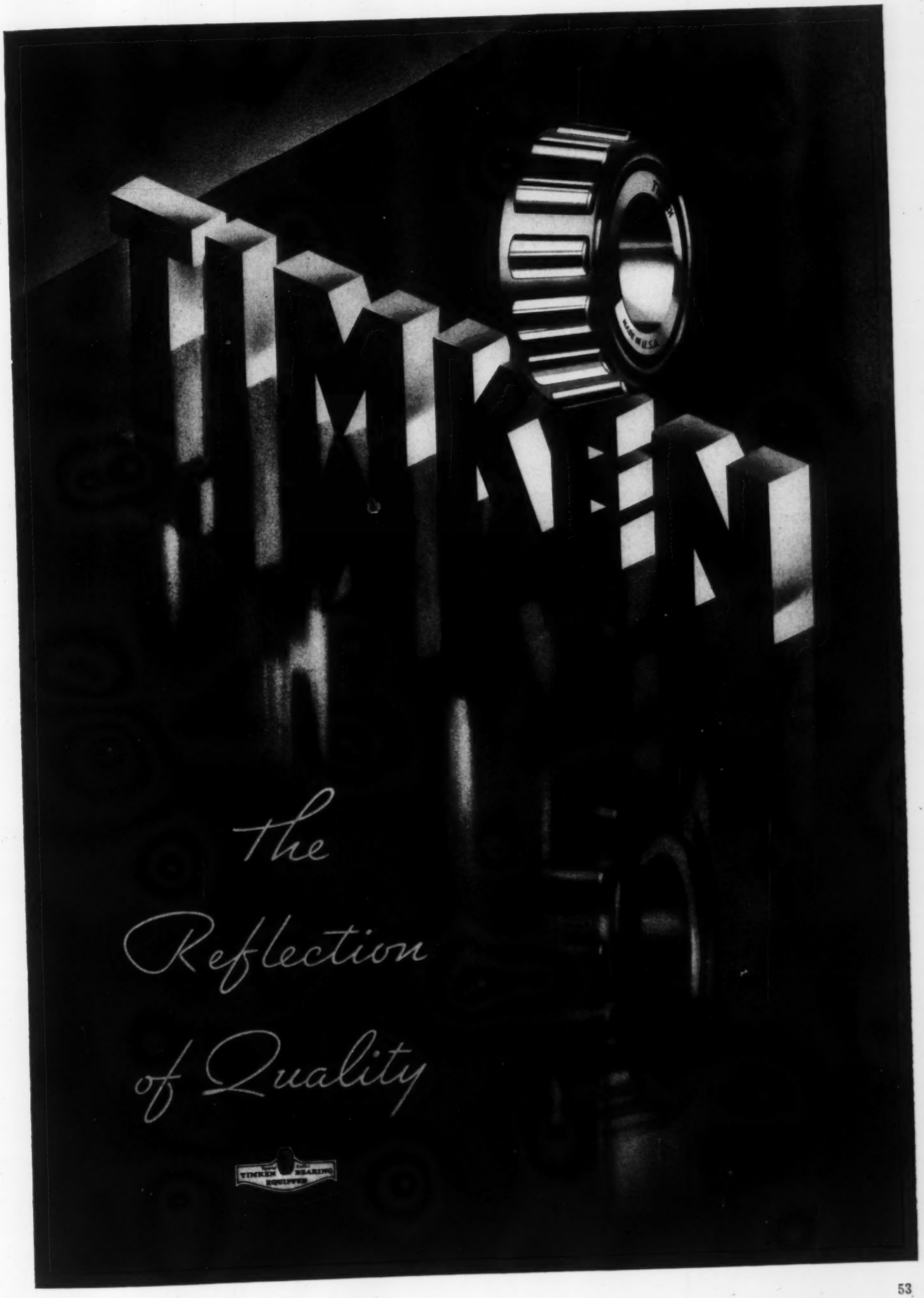


Fig. 1—*Portions of glass are severed from a stream of semi-molten material by reciprocating movement of cutter*

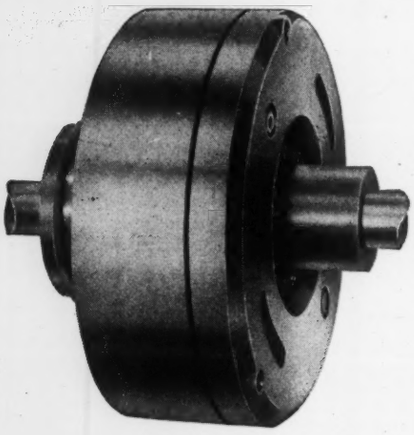
shear member 47,A When bar 46 is at the extreme left end of its stroke the parts are in the relationship indicated.

As bar 46 starts to travel toward the right, cutting edge 65 impinges upon stream 31 as illustrated in drawing *B*. Presently edge 65 comes into shearing relationship with the right-hand edge of the aperture, causing gob of glass 73 to be severed from the stream.

The operation is repeated during each stroke of bar 46, with the result that the reciprocating movement severs and discharges a gob first in one direction and then the other. The shearing device is actuated by articulating one end of bar 46 to the piston rod of a work cylinder operated by air or steam. Helically grooved rolls receive the gob of plastic glass, indicated at 74, which is then continuously twirled and kneaded while being conveyed longitudinally. By the time the glass mass reaches the discharge end of the


TIMKEN
the
Reflection
of Quality
TIMKEN BEARING
EQUIPPED

WHAT—



Type of Clutch?

IF you want ease of remote control, safety, smoothness of action—

If you have to solve a problem in synchronization, mechanical or electric braking problems—

If you require low W R^2 and high torque—

Then a Dings Magnetic Clutch is the answer.

Dings Magnetic Clutches will not overheat. Oil and grease cannot work into the friction surfaces. Release is positive. Greater torque and longer life is secured through tested design and liberal friction areas.

—And there is a Dings design to answer any problem of synchronization, remote control, low W R^2 and quick stopping.

If you are figuring on a clutch in your present designing you should find out about Dings Magnetic Clutches.

They are backed by nearly 40 years of the building of magnetic equipment.

EXPERIENCE

that saves money

No other manufacturer can offer you the years of experience in the building of magnetic equipment that is Dings'. Since 1899 Dings engineers have been solving separation, magnetic protection and power transmission problems, supplying the major needs where magnetic equipment is required.

This experience is your assurance of dependable advice, helpful cooperation and a proved product. There is no cost in taking advantage of it.

DINGS MAGNETIC SEPARATOR CO.
666 Smith Street, Milwaukee, Wisc.

Dings *High Intensity* MAGNETIC CLUTCHES

rolls it is spherical, hardened and ready for cooling.

The patent, designated No. 1,993,235, is assigned to Lawrence Glass Novelty Co.

A CLUTCH designed to release upon occurrence of an excessive load has been patented by Edwin L. Connell, East Cleveland, O. In carrying out his idea he utilizes a spring mechanism, the principle of which has proved effective in one-revolution clutches, free wheeling devices, etc.

When the operator by means of switch trigger 4, *Fig.* 2 *A*, starts the motor in housing 1, rotary movement will be transmitted through pinion 6 to gear 7 and rotate clutch head 11 on which is tooth 12. Assuming that the motor is

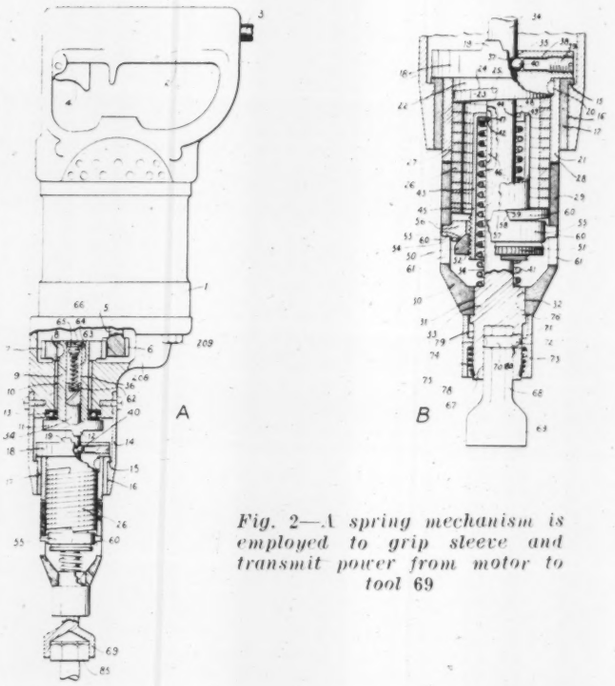


Fig. 2—A spring mechanism is employed to grip sleeve and transmit power from motor to tool 69

to drive a nut or bolt screwing wrench such as 69, the operator presents the wrench to the work as shown in the drawing. By pushing on the wrench by means of handle 2, shaft 34 will be moved upwardly against spring 63, carrying clutch head 18 upward to engage the tooth 19 with tooth 12 of clutch head 11. Thus the torque of the motor will be transmitted to head 18.

Sleeves 21 and 29, *Fig.* 2 *B*, move upwardly with the shaft, and rotary movement of the head 18 is communicated to spring 26 through notch 25. Rotational movement of the spring around its axis is transmitted from the lower end of spring 59 to cam surface 58 and then into cam projection 57 and into clutch device 55. By means of lugs 60—60 the clutch device 55 ro-

How TO GET MORE FOR YOUR MONEY when buying motors . . .

CHECK THE FRAME—This is important, because motor frame sizes are standardized. Thus the frame which has the necessary strength and rigidity with least bulk will allow more room for more copper and iron in stator and rotor. It also will provide larger openings for greater ventilation.

CHECK THE STATOR—Its laminations should be 28-ga. high silicon steel, heat treated, to insure high resistance, low retentivity and perfect insulation. There should be a maximum of iron in the stator section so that there is less idle current. The coil noses of the windings should be extremely short for the most effective use of copper.

CHECK THE INSULATION—It should be permanently pliable—should never dry out or crack. Not only should the insulation be waterproof but also highly resistant to acids, fumes and dirt.

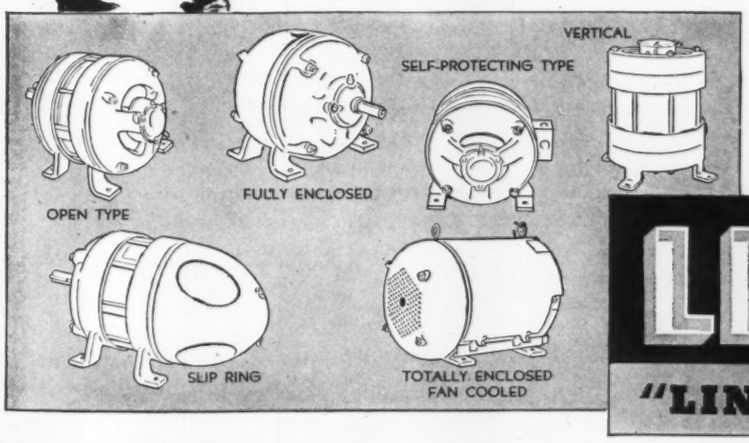
CHECK THE ROTOR—Be sure the laminations are not dependent on the windings to hold them together. The windings should be a single piece of metal to provide a perfect electrical circuit. The rotor shaft should be extra large, accurately machined and ground. Fans should have many steel vanes to whip large volumes of air through motor to insure cool operation.

CHECK THE PERFORMANCE—Motors which have the recommended features of construction will outperform all others. Will deliver extra horsepower without sacrifice of power factor or efficiency. Will give you more dependable service for your money. Will bear the name "Linc-Weld" on the nameplate. The Lincoln Electric Company, Cleveland, Ohio.

M-15

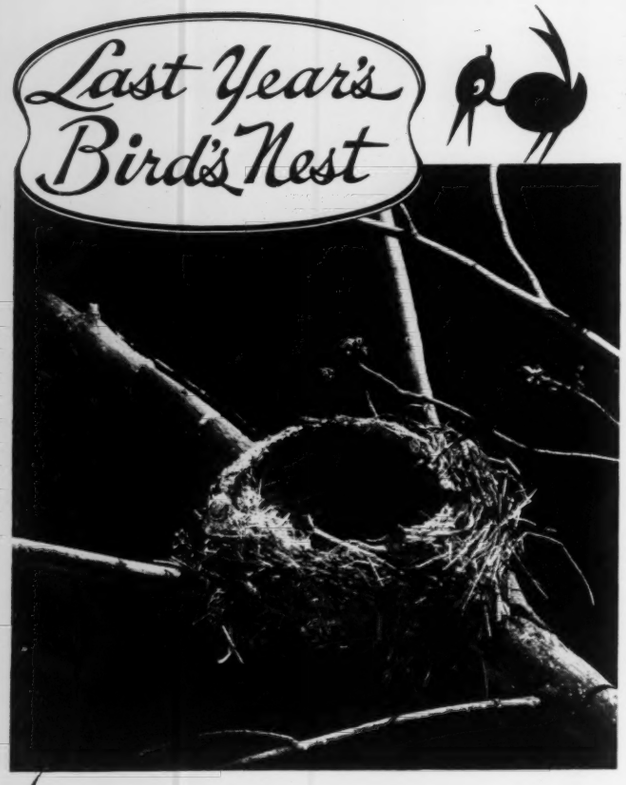
LAD "Congress, it seems, will do nothing about birth control."

POP "Yes, and it's too late for birth control to do any thing about Congress . . . so it gets back again to individual preference . . . just as I put it up to our plant electricians as to what motors I should buy—they all wanted *'Linc-Welds.'* Better they should have what they want than to say, 'You *must* take this and like it'."

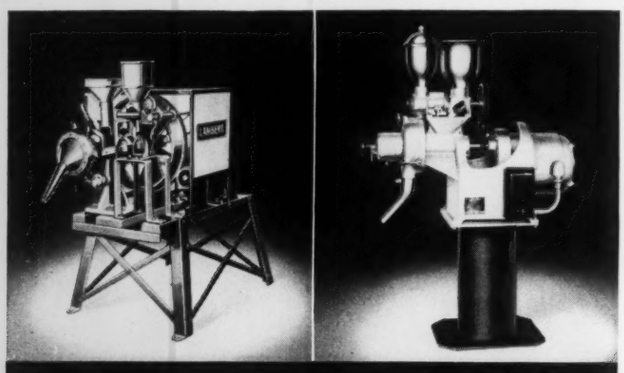


LINCOLN

"LINC-WELD" MOTORS



never interested a new customer, and machinery of an antiquated design is just as lacking in appeal. New design that is fundamentally sound inherently adds new features . . . new uses . . . lowered costs . . . real sales advantages. Your design problems will be greatly reduced by the use of Master Guaranteed Motors, in either Geared Head or Standardized types. Master Engineers welcome every opportunity to assist in the selection of the motor best suited to your particular requirements.



THE MASTER ELECTRIC COMPANY
DAYTON OHIO U S A

tates the lower sleeve 29, head 33 and wrench 69.

When the bolt or nut 85 being turned resists turning movement, end 59 of the spring will be forced against cam surface 58 with a substantial amount of force that will cause spring 26 to tend to unwind, causing it to expand diametrically and to grip the inner wall of sleeve 29 as well as the inner wall of sleeve 21.

A relatively small force on the end of spring 26 will be sufficient to cause the spring to grip the sleeve with a great torque-transmitting frictional engagement. Full power of the motor now may be transmitted through spring 26 and thence by its frictional engagement with sleeve 29, through the latter and to tool 69.

Although the force between end 59 of the spring and the cam surface 58 is a relatively small force compared with the force transmitted to sleeve 29, nevertheless it will vary in proportion to the total torque transmitted. Thus, if the load transmitted to wrench 69 rises to a predetermined value such as for example the torque load desired to seat a nut or bolt head effectively, the force transmitted by the end 59 of the spring will likewise reach a predetermined value at that point. When such force value is reached the end of spring 59 acting on surface 58 as upon a cam, will ride over the cam surface 58, pushing the clutch device 55 as a whole downwardly against the opposing tension of spring 41. Transmission of torque therefore will cease immediately and at each revolution of spring 26, the end 59 will trip over the clutch surface 58.

The value at which the clutch thus releases may be adjusted or varied by turning the nut 50 one way or the other to change the tension of spring 41. Number of the patent is 1,954,620.

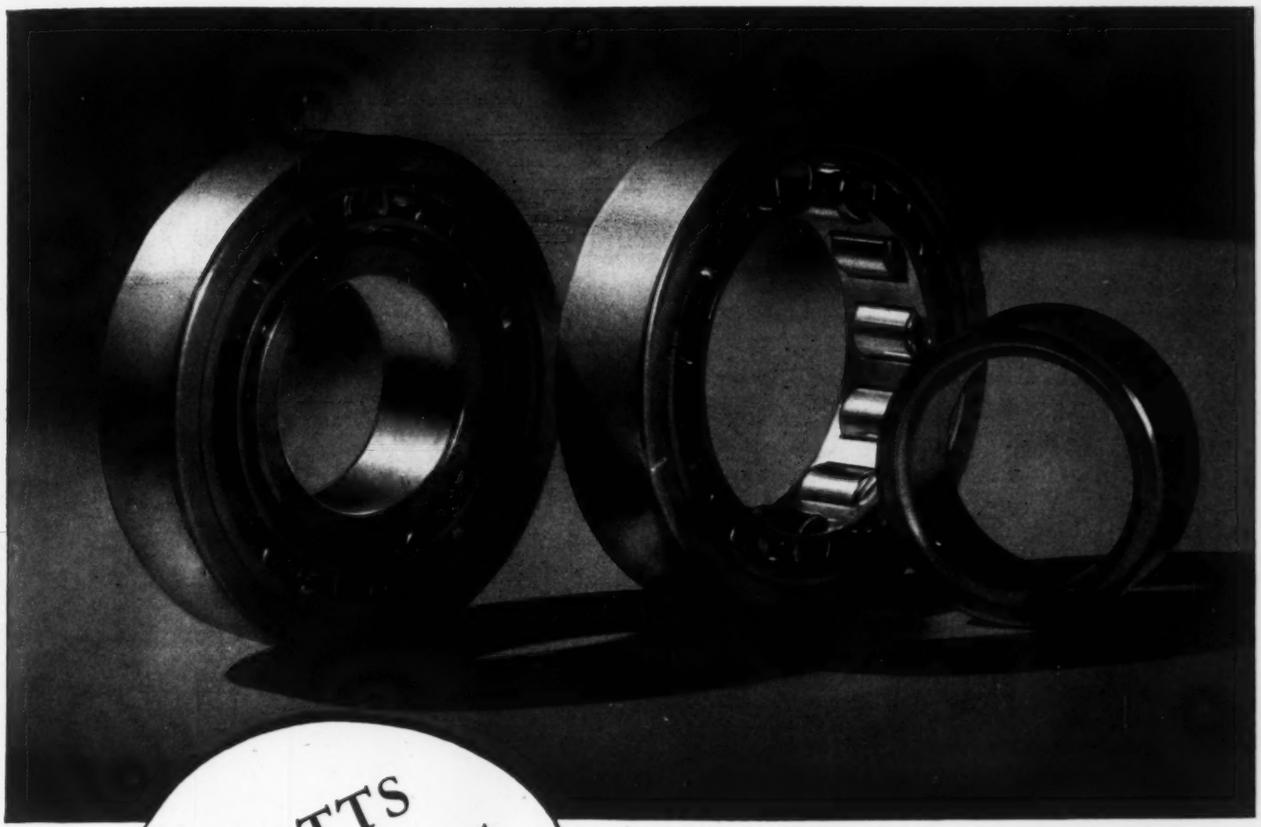
What's Behind the Pivoted Motor Drive?

(*Continued from Page* 36)

life and burned-out bearings. On the other hand, as T_1/T_2 increases, T_2 decreases, and excessive slippage will eventually take place.

To avoid both of these dangers, a suitable value of the tension ratio must be found which will give safe yet effective tensions. Such a choice depends on experience rather than theory, and is therefore a matter on which engineers may be expected to disagree. From the results of belt tests conducted over a period of years, together with favorable reports from a considerable number of pivoted-motor drives now in operation, the author has adopted for his own use the curves of *Fig.* 4, which apply to paper motor pulleys.

We have now to detemine what horizontal distance between the pivot and the motor shaft will give the tension ratio desired. This will depend on the maximum load to be transmitted,



Hyatt HY-LOAD Solid Roller Radial Bearings shown complete with inner race and with inner race removed.

HYATTS ARE RIGHT *from the* START

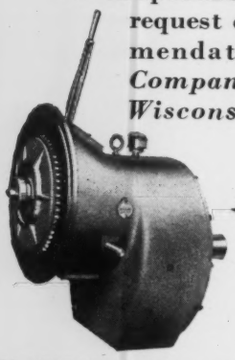
Throughout the many years Hyatt Roller Bearings have been serving and saving, three outstanding reasons we like to believe are responsible for their widespread use. Continuous development of correct design, quality manufacture and sound application engineering. In product design, product manufacture and product application Hyatt factory and field forces are diligently striving to keep Hyatt Roller Bearings not only abreast of demands but as far out in front as possible.

Thus with Hyatt Roller Bearings right from the start—designed right, built right, and applied right—you have the answer to dependable performance wherever these better bearings are used. Hyatt Roller Bearing Company, Newark, Detroit, Chicago, Pittsburgh, Oakland.

HYATT
ROLLER BEARINGS
PRODUCT OF GENERAL MOTORS

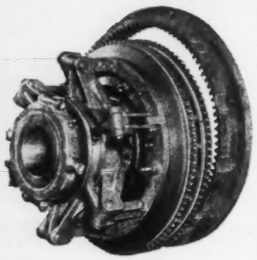
DESIGNING THE CLUTCH
to fit the job

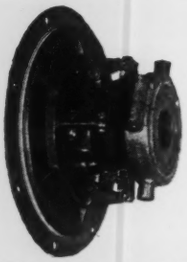
New clutch types of greater adaptability and wider uses have been added to the more than 400 types and sizes of Twin Disc Clutches and Power Take-off Units already developed by seventeen years of clutch specialization. Engineering data on request or write for specific recommendations. ***Twin Disc Clutch Company, 1325 Racine St., Racine, Wisconsin.***



No. 8301 Reduction Gear Unit for General Industrial Use.

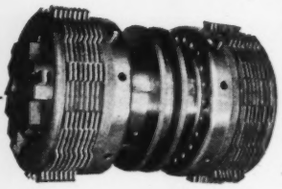
No. 8098 Model CR-2-18 Clutch for Oil Field Equipment.

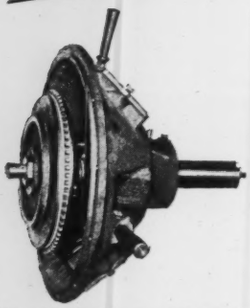




No. 5738—C-10 Toggle Action Clutch for Use on Tractors.

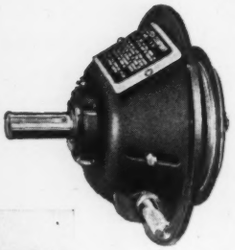
Close Coupled Duplex Model Wet Type, Multiple Disc Clutch.





No. 7350 G. T. Gear Tooth Power Take-off Unit for General Industrial Use.

No. 7963 Power Take-off Unit for Use on Combine Harvesters.



TWIN DISC CLUTCHES

the motor weight, belt speed, and general layout of the drive.

Designate by e this required pivot distance or overhang, and let

R = value of tension ratio to be used
W = weight of motor
N = motor speed at full load
P = maximum load to be transmitted. (A safe value for peak starting load will usually be obtained by multiplying the name-plate rating by 1.5 if the motor is compensator started, and by 2.5 if started across the line.)
D = diameter of driven pulley
d = diameter of motor pulley
$r = d/2$ = radius of motor pulley
h = height of motor shaft above pivot (obtained from dimension sheets of motors and pivoted-motor bases)
$k = 126{,}000/Nd$
m = angle of slant of tight strand of belt
n = angle of slant of slack strand of belt
x = horizontal distance motor shaft to driven shaft
y = height of driven shaft above motor shaft (negative when driven shaft is below motor shaft)
C = center distance between shafts

Equation (6) may be written in the form

$$R = T_1/T_2 = \frac{(eW/kP) + b}{(eW/kP) - a} \qquad (6)$$

This gives

$$Ra + b = (R-1)eW/kP \qquad (8)$$

By drawing a figure (such as that shown in *Fig.* 5) it appears that the lever arm of the belt pulls about the pivot are

$$\left.\begin{aligned} a &= h\cos m + e\sin m - r \\ b &= h\cos n + e\sin n + r \end{aligned}\right\} \qquad (9)$$

in which r has a positive value when the tight strand is on the pivot side of the pulley, and negative when the slack strand is on the pivot side.

Substituting these values of a and b in Equation (8)

$$e(R-1)W/kP = R(h\cos m - r) + Re\sin m + h\cos n + e\sin n + r$$

Finally, solving this for e

$$e = \frac{h(R\cos m + \cos n) - (R-1)r}{(R-1)W/kP - R\sin m - \sin n} \qquad (10)$$

Equation (10) is the working formula for e. In using it, the following conventions regarding signs must be adhered to:

Give r a positive value when T_1 is on the pivot side of the pulley and negative when T_2 is on the pivot side.

Give h a negative value if the pivot is higher than the motor shaft, as in wall or ceiling mountings.

The angles m and n are measured upward from a horizontal axis through the motor shaft drawn toward the pivot side. If either strand of the belt slopes downward from the motor pulley, the corresponding angle is therefore negative. In ceiling drives and in vertical drives, cases may occur in which some or all of the cosines and sines are negative.

In computing the angles m and n, find

AUTOMATIC BURNER CORP.
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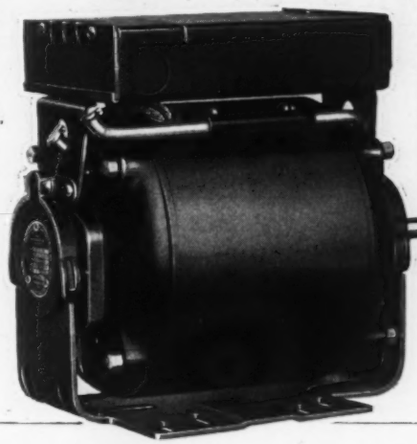
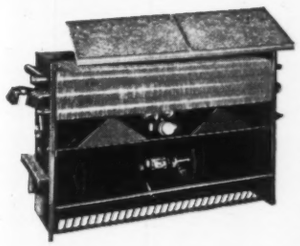


REPUTATION



CARRIER COMES DOWN THE "PATH"

Carrier engineers know that it requires years to build up a good reputation — and that it doesn't take much to tear one down. They also know that the failure of a single part can quickly destroy the good will behind a product. Therefore, in developing Carrier "Weathermakers" for homes and offices, these men spent years in research, in testing and perfecting each vital part of the "Weathermaker" units. And Emerson's reputation for building good motors — almost half a century — was perhaps instrumental in persuading the Carrier Engineering Corporation, a leader in the new industry, air conditioning, to investigate Emerson's fitness to design a motor for their needs.

Build a *better* product — and the world will make a beaten path to your door. Ralph Waldo Emerson, eminent in American literature, penned this philosophy; and Emerson, pioneer in the motor industry, has been singularly successful in its application.

Research engineering that delves into every phase of material analysis; design, operation and endurance — scientifically equipped laboratories — a plant with unsurpassed facilities for precision manufacturing, manned by skilled craftsmen who employ these facilities to the fullest advantage — that's how Emerson's reputation as a builder of *High Quality* Motors has been achieved.

There are 545 appliances powered by *small motors. Emerson's engineers have developed motors for almost half of them — ample evidence that the "beaten path" leads to Emerson's door.

To learn more of the advantages of Emerson's individually designed motors — and what makes them so suitable for products in your field — write today for Booklet 6-M.

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EMERSON MOTORS

3 HP and smaller — Single-phase — Polyphase — Direct Current

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LEADERS IN THE FAN AND MOTOR INDUSTRY SINCE 1890

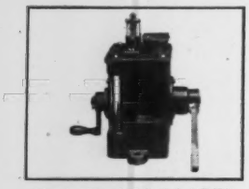
Why you should use

HILLS-McCANNA

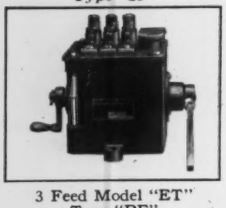
LUBRICATORS

on your

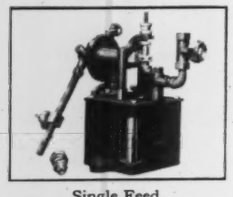
Equipment



Single Feed Model "ET" Type "SF"



3 Feed Model "ET" Type "BF"



Single Feed Model "MB"

They are known by practically every operating engineer as the most efficient means for the mechanical application of oils to bearings and other friction surfaces.

All Hills-McCanna Lubricators are based on the single plunger pumping principle with ball valves and stuffing boxes, which is the most efficient means of pumping and metering liquid substances.

Provision has been made on all lubricators to check oil delivery on the discharge side of the pumping unit. The operator, at all times has visible evidence that the Lubricators are functioning. The Lubricators are built to last for years, with as few working parts as possible, combined with simple rugged construction.

Catalog and engineering information on request.

HILLS-McCANNA CO.

2343 Nelson St., Chicago, Ill.

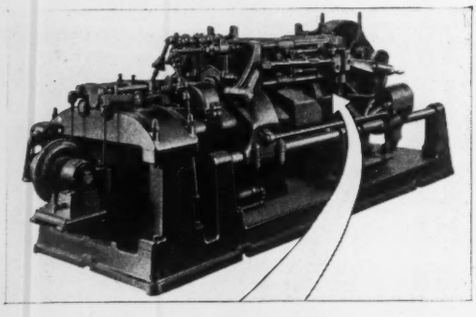
Manufacturers of

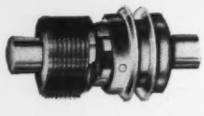
Chemical Proportioning Pumps and Centrifugal Pumps, Valves for all services, non-ferrous alloys, Valves for Tank Car Outlets.

First in the Field of Force-Feed Lubrication

PULLMORE CLUTCHES

Used by Madison-Kipp





A Pullmore Clutch is standard equipment in the No. 5 Automatic Die Casting Machine made by Madison-Kipp Corporation, Madison, Wis., shown above. Operation of this machine calls for exceptional strength and reliability in the clutch. These qualities are provided amply by the Pullmore which also is extremely durable, compact, and adaptable to the design of the machine. For the same qualities, other leading manufacturers use Pullmore Clutches in a wide variety of modern machines. Pullmore Clutches commend themselves to engineers, designers, purchasing agents, and others interested in reliable low-cost power transmission and control. Write for catalog; and details of our free engineering service. Get complete information—write us today.

ROCKFORD DRILLING MACHINE CO.

304 Catherine Street, Rockford, Illinois

Sold by MORSE CHAIN CO., Ithaca, N. Y.

With offices in principal cities.

A = half the angle between belt strands

$$= \sin^{-1} \frac{D-d}{2C}$$

Accordingly, A will be negative when d is greater than D, i.e., in "speed-up" drives.

Also S = angle of slope of center line of shafts $= \tan^{-1} y/x = \sin^{-1} y/C$.

S is negative when y is negative.

Then

$m = S - A$ when T_1 is on pivot side of pulley
$= S + A$ when T_2 is on pivot side of pulley
$n = S + A$ when T_1 is on pivot side of pulley
$= S - A$ when T_2 is on pivot side of pulley

If preferred, we may lay out the drive to scale, and measure m and n, instead of computing them. This plan will usually be quicker and less liable to error than the computation.

Having obtained the value of e, we may now compute the lever arms of the belt tensions a and b from equations (9), or we may measure them on the scale drawing. The tensions are then readily found from equations (3) and (4).

As a check, note that the values of the tensions found should satisfy the relations $T_1 - T_2 = kP$, and T_1/T_2 = the value of R originally chosen.

In the short-center drive between fixed centers, the initial tension under which the belt is installed is almost never known, and is usually the result of guesswork. On the other hand, the pivoted-motor drive provides a means of knowing what the initial tension is, and of adjusting the running tension to the load to be carried. At constant load, the effect of belt stretch is taken care of by a corresponding change in center distance. The stretch of a new belt simply results in a gradual drop of the base arms below the level position, and this is easily corrected while the motor is running.

The foregoing discussion suggests certain points which the designer will do well to keep in mind. Some of these are:

Avoid low belt speed by proper specification of motor speed and pulley diameters.

Avoid extremely short center distances and high pulley ratios, since small contact angles require low tension ratios.

Use only high-capacity belts, since the belt tension demanded by the drive varies decidedly with the coefficient of friction.

Whenever possible, the lever arm of the tight strand with respect to the pivot should be kept small and less than the lever arm of the slack strand.

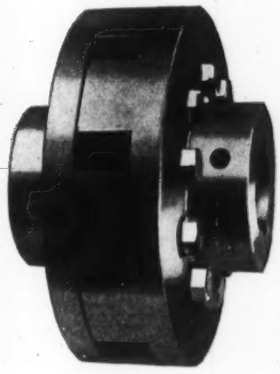
An upward-sloping drive, if not successful, may often be made so by raising the motor on a pier, so as to decrease the lever arm a.

Evidently the pivoted-motor drive is not a cure for all ills, nor is it advisable in all cases, but it is an exceedingly useful device with the great advantage that the engineer can predict in advance of installation whether a given design will work or not. If it will not, he will be able, in most cases, to decide on a satisfactory remedy.

New Materials and Parts

Couplings Overcome Misalignment

TYPE P flexible couplings recently developed by Lovejoy Tool Works, 5018 West Lake street, Chicago, have individual free-floating load cushions hung between jaws on removable studs. These couplings, shown herewith, are available for shaft diameters from three to ten inches. The cushion material is either a long wearing brake lining material, employed for heavy shock loads; leather for use on sustained loads and when greater misalignment exists; or



Individual free-floating load cushions are employed in improved flexible coupling

rubber duck fabric, vulcanized under pressure, for use on fluctuating loads and where high resilience is required.

Load cushions are in plain sight for inspection at all times and can be removed and replaced in a few minutes when necessary. There is no wear on the iron or steel jaws. No lubrication is required. In operation, one half of the cushions are idlers (except on reversing load); hence there always is a set of new cushions in the coupling. This feature eliminates shut-downs, as load cushions can be easily and quickly interchanged without dismantling the coupling.

Belt Idler Is Self-Aligning

AN IMPROVED type of self-aligning idler for troughed conveyor belts is announced by Link-Belt Co., Chicago. The unit, shown herewith, is made up of standard belt carrying rolls installed in a supporting frame provided with arms on which actuating rolls are mounted for the purpose of swiveling the idler frame promptly when a crooked running belt crowds sidewise enough to engage either of them. This trough-

Maximum Bearing Quality Is Made Available Only By Correct Design...

● There is a quite general failure to appreciate the importance of bearing design in its relation to bearing performance. Alloy specifications do not cover all requirements.

The bearing must be designed in the proper proportions as regards length to diameter. It must be grooved or not grooved so as to distribute the lubricant properly and maintain an adequate oil film between the journal and the bearing at the point of closest approach. The good qualities of a perfect bearing are made available only through correct design.

For these sound reasons we welcome an opportunity to collaborate with you or your engineering department at the time bearing specifications are being considered. A vast experience with infinitely various bearing designs and applications, and years of constant research enable us to give valuable assistance. This consulting service costs you nothing—you are in no way obligated.

Why not avail yourself of it?

THE BUNTING BRASS & BRONZE COMPANY, TOLEDO, OHIO

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BUNTING Bunting Quality **PHOSPHOR BRONZE BUSHINGS • BEARINGS**

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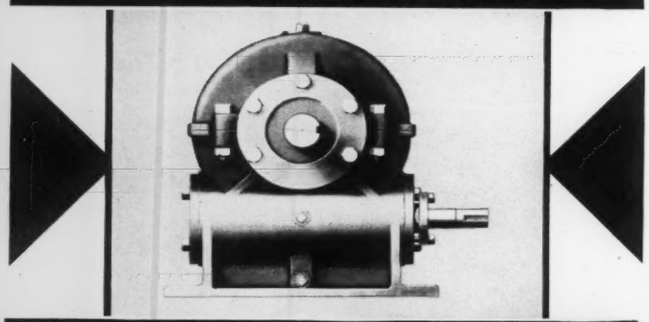
There is much more to speed reducer design than meets the eye. Just as power transmission problems differ, so do those of speed reduction. Ohio builds reducers in types and sizes to meet every condition. Each possesses superior qualities for its particular purpose which insure longer



life, lower cost and a more even flow of power. May we explain these advantages to you, at your convenience?

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Brown & Sharpe Pumps
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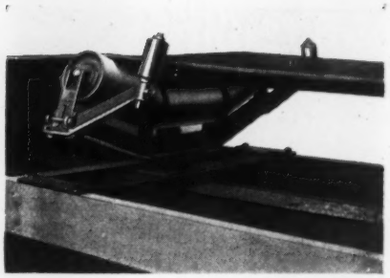


Idler frame is swiveled when a crooked running belt engages actuating rolls

ing idler frame is supported by an antifriction pivotal bearing, carried on a cross member or subframe bolted to the conveyor stringers.

Nickel-Copper Alloy Announced

KNOWN as Yoloy, a new alloy steel has been announced by Youngstown Sheet & Tube Co., Youngstown, O. The material is a nickel copper alloy steel having exceptional resistance to corrosion, high tensile strength combined with high ductility, workability and weldability. Yoloy steel is produced in sheets, strips, plates, bars, shapes, wire and seamless pipe.

Switches Incorporate New Principle

PRODUCTION of the new line of Colt-Noark type C safety switches now is under way, Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., has announced. The 575-volt series has been completely revised. Incorporating an advanced switching principle, these new models, shown herewith, utilize the sliding switching member which causes each leg of the circuit to

Each leg of the circuit is broken at two points instead of one in new line of safety switches

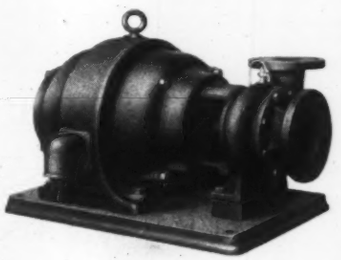
be broken at two points instead of one. Another feature is the new type unit blocks, each of which may be removed wholly or in part for cleaning or replacement of contacts without disturbing the rest of the switch.

The new cabinets have been redesigned in order to allow for closer banking and a new type handle has been provided which hugs the side of the box closely in order to save installation

space. The cover, hinged on the front instead of the side, also aids in the conservation of space and at the same time increases the ruggedness of the box. A new cover catch has been installed that is more efficient in operation.

Develops Larger Pumping Units

TWO LARGER units have been added to the line of Monobloc centrifugal pumping units being manufactured by Worthington Pump & Machinery Corp., Harrison, N. J. The new pumps, of sizes 3 and 4-inch, are essentially similar in design to the smaller units of the line. These larger units, besides being rigidly mounted on the motor frame, are supported by a foot resting on the base. The pump impeller is mounted directly on the motor shaft and both pump and motor are bolted to one rigid base, thus relieving the pump from possible pipe strain. Additional improvements are in impeller design, renewable wearing rings, and balance rings that eliminate end thrust and put the stuffing box under suction pressure only.



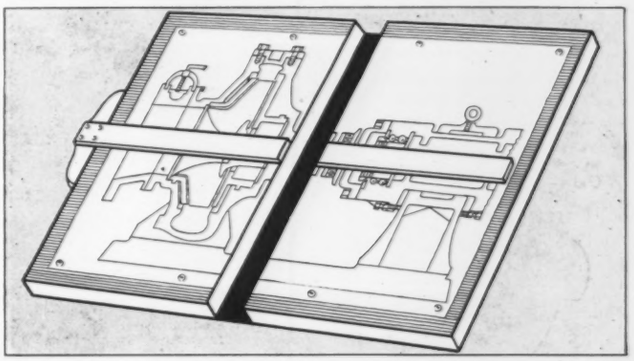
A variety of material combinations are available in large centrifugal pumping unit

A choice of a variety of material combinations permits selection of the pumps for a widely diverse character of service. In the matter of fittings, these pumps can be furnished in standard bronze, all bronze, or all iron. Electrical characteristics may be any standard or any specials.

Mobile Circuits Are Introduced

A SYSTEM of providing mobile electric circuits for portable tools so that work can be followed along conveyor and assembly lines without the use of cords and cables has been introduced by Switch & Panel division, Square D Co., Detroit. The system is known as Trolley SQUARE-Duct and consists of an almost entirely closed duct containing stationary busses, along which travels a carriage or trolley. Collector wheels of the trolley transmit the current by means of wire connectors to the tools. One type of duct section has a "gate" which can be pushed back, permitting the removal or insertion of a

THE DESIGNER *skipped* THE
PACKING POINT*



but . . . GRATON & KNIGHT
bridged the gap

The blueprints finished, the designer got down to cases, began to consider if the new design he had created were feasible. In his planning, he had skipped over the "packing point"—taking it for granted he could get what he wanted.

But no such packing was on the market, and it began to look as though the new idea might fail for lack of a packing. Then he called in Graton & Knight.

Nothing like it had ever been built—a flat piece of leather with a circular channel and no seams—and even Graton & Knight weren't sure it could be done. But Graton & Knight engineers, knowing that *their* "Lab-tec" leather packings (protected by laboratory accuracy) can be put to uses never before thought possible, stepped in and did the job . . . making it possible for one of America's largest firms to get another jump on its competition.

STOPPED AT THE PACKING POINT?

Let Graton & Knight show you where and how "Lab-tec" Leather Packings can do the job.

Lab-Tec Leather Packings are laboratory tested against the effects of wear, heat, water, air, semi-corrosive liquids, etc. Before specifying packings, consult Graton & Knight.

—The "Packing Point" is the point in the design of the machine where the problem of packing enters—the point where, we suggest, you consult Graton & Knight.

"Creating Success at the Packing Point"

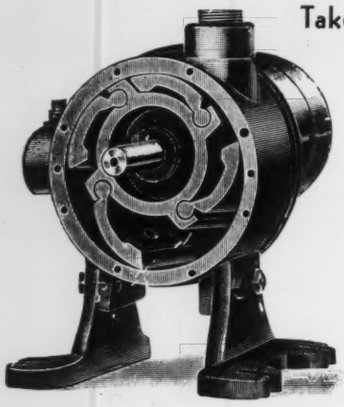
2101

LEIMAN BROS. Patented Rotary Positive

AIR PUMPS

Pressure — Vacuum — Gas Pumping

AIR MOTORS



Take up their own wear
No packing or
tips on the wings

The built-in one-year-lubrication of Leiman Bros. Rotary Positive Air Pumps is the new wool yarn packed bearing which holds in suspension enough lubricating oil for one year's service—strained and purified.

The continuous unbroken cylinder surface makes these always noiseless air and gas pumps doubly quiet. The air enters and emerges in a sidewise course through the by-pass in the cylinder head side.

This means a smooth, glassy-like cylinder surface, easy operation and saving in power.

The advantage gained by this simple construction is that the wings in constant operation will wear in conformity with the inner cylinder wall and become smooth and glassy like as well as case hardened in use, and maintain a perfect fit and positive air pressure, even after long continued usage.

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on every drop forged machine part is a guarantee of strength and long life. To insure ultimate satisfaction from every machine you design, be sure to *specify Kropp forgings.*

No matter what the size, shape or steel specification, we can make it—drop forgings to 700 pounds, steam hammer forgings to 30 tons. Complete heat treating and machining departments are available for finishing forgings to your most exacting specifications.

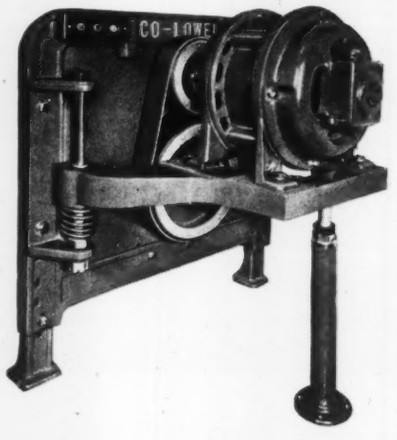
We make "forgings to your specifications"—send drawings for quotation.

Kropp Forge Company
5309 W. Roosevelt Rd.,
Chicago, Illinois

trolley. Curved sections are also manufactured to meet requirements. Feeders or subfeeders can be brought into the system at any point by means of special connection boxes.

Drive Bases Are Floor Mounted

THREE new drive bases for spinning frames have been added to the line of standard floor mounting bases being built by Rockwood Mfg. Co., 1801 English avenue, Indianapolis. The drive base shown herewith employs the vertical drive principle. The motor is mounted above the driven pulley to give maximum clearance from the floor and to permit a wide range in the selection of pulley sizes, belt lengths and driven speeds. Belt tension is maintained by springs beneath the motor shelf. Operators are kept away from the moving belt and pulleys by the design of the base which acts as a guard around the drive. Speed changes are accomplished by changing the driven pulley diameter. The drive is reversible without any change or adjustments.



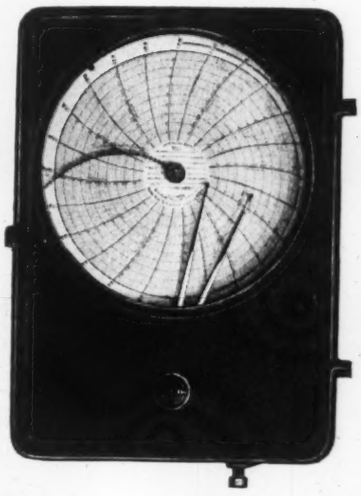
Improved drive base for spinning frames employs the vertical drive principle

Another base recently developed is constructed so that the motor is mounted 8 inches off the floor. Simple adjustments establish correct belt tensions and pulley alignment when the drive is installed. The pivoted motor weight then assures uniform transmitting capacity. A third development is a shelf-type spinning frame drive designed for shelf or bracket mounting of motors. The pivoted motor base is recessed in a welded steel shelf, making a neat as well as sturdy installation.

Instrument Appearance Is Improved

SIMPLE lines and velvet black finish have been adopted for improved appearance of the flow control instruments developed by American Meter Co., 60 East Forty-second street, New York. The case body and door of the instruments, shown herewith, are cast of

aluminum alloy. Chart dial size has been made such that the pressure spring, stuffing box and other working parts are visible when the door is open. The improved case is now standard for



Simple lines have the case of im- been adopted for proved flow con- trol instruments

the company's entire line of recording and integrating flow and orifice meters, rate-volume controllers, liquid level indicators and controllers.

Electronic Device Protects Magnets

DESIGNED to prevent insulation breakdowns in direct current magnets, solenoids, shunt and compound wound motors and generators and similar mechanisms due to the high voltage self-induced surges which occur when the circuit is suddenly opened, new Magnet Protector Tattelites have been brought out by Littelfuse Laboratories, 4507 Ravenswood avenue, Chicago. The device is connected directly across the equipment to be protected. Its characteristics are such that no current flows until the voltage reaches a dangerous value; the device then suddenly connects and shunts out the surge.

Switch Enclosures Are Dust Tight

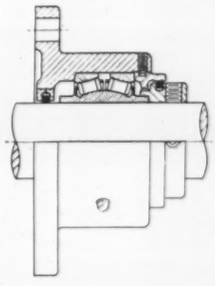
SHEET metal enclosures of dust-tight construction are now available for the bulletin 709 switches of sizes 2 and 3 being manufactured by Allen-Bradley Co., 1311 South First street, Milwaukee. The new line of switches available in these enclosures will satisfy polyphase motor requirements up to 15 horsepower, 110 volts; 30 horsepower, 220 volts; and 50 horsepower, 440-550 volts; as well as self-starting single phase motors.

The type E enclosure is black enameled on the outside with a white enameled interior finish which reflects the light onto all terminals, switch parts, and overload relays, thereby add-

SHAFER

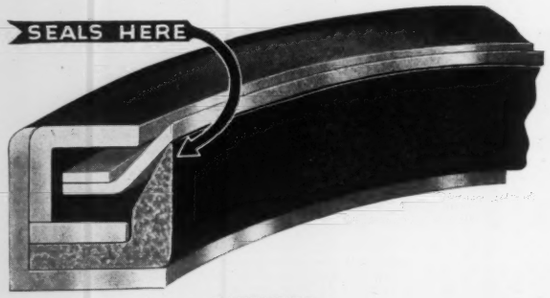
roller bearing
FLANGE UNIT

● . . . a necessity for modern welded machine construction, where accurate alignment is always difficult. Shafer flange units mean simplest installation — and Shafer CONCAVE roller design provides full self-alignment within the bearing itself, an automatic assurance of free-rolling, full capacity performance.



Catalog No. 12 gives complete data on Shafer Flange Units • Pillow Blocks Take-Up Units • Hanger Boxes • Cartridge Units • Duplex Units • Conveyor Rolls • Radial-Thrust Roller Bearings

Shafer Bearing Corporation
6513 West Grand Avenue Chicago, Illinois



PATENTED

Gits Precision Oil Seal

Construction Exclusive Feature

Note the improved form of flexible leather washer which prevents the leakage of oil from the housing.

The leather washer is tapered where the pressure of the flat spring clamping ring is applied.

The flexibility of the tapered leather requires but a slight pressure to be contracted and effectively seal with minimum friction on shaft.

The sharp edge of the tapered washer shears the oil film preventing escape of oil.

Send for Catalogue

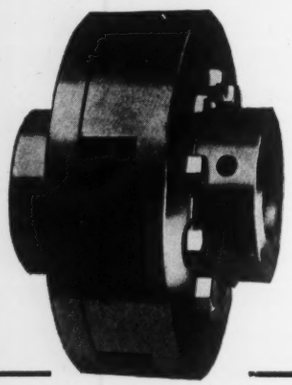
GITS BROS. MFG. CO.
1861 S. Kilbourn Avenue - - Chicago, Ill.

L-R FLEXIBLE COUPLING TYPE "P"

Has individual free-floating load cushions hung between jaws on removable studs. Offers compactness, simplicity and ease of installation. Requires no lubrication. *Efficient.* Load cushions always in plain sight for instant inspection and cushions can be replaced without tearing down coupling—guaranteeing satisfactory performance under continuous operation. 3" to 10" shaft sizes.

Machinery designers will find the new L-R Type "P" Data Sheet invaluable. Write for it.

LOVEJOY TOOL WORKS
5018 WEST LAKE ST. CHICAGO, ILL.



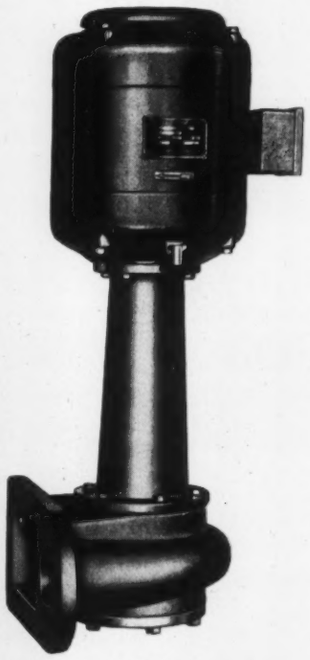
ing to the ease of installation and inspection. Dust-tightness is obtained with a thick felt gasket between the cover and base. Hinged bolts and wing nuts hold the cover tightly in place. This starter is suitable wherever dust-laden air

White enameled interior of dust-tight switches reflects light onto interior parts

is encountered, except for Class 2, Group D hazardous locations, where the type D dust-tight gasketless enclosure is recommended.

Pipeless Pump Is Announced

ALL pipe, hose or tubing connections to the pump have been eliminated in the design of the model 11027 gusher pump by Ruthman Machinery Co., Cincinnati. Flow in the pump, shown herewith, is carried as follows: The in-



Pump unit which does not require external pipe, hose or tubing operates in a vertical position and is motivated by a built-in motor

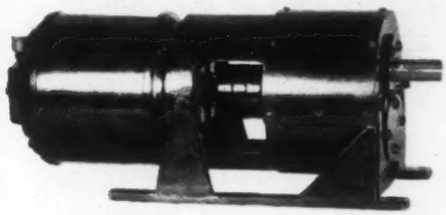
take supply flows into the pump by gravity through the opening provided in the mounting pad on the side of the machine; and the discharge is transmitted directly into the base of the machine. The delivery or discharge pipe is con-

nected, independently, to the inside wall of the reservoir, in line with the discharge opening in the pump. This design makes it possible to confine the piping to the inside of the machine, and have the pump fastened, independently, with cap screws through the mounting bracket which is cast integral with the pump.

The unit operates in a vertical position and is motivated by a built-in motor. There are two separate compartments which communicate independently with the upper and lower eyes of the impeller. When in operation, the resulting double pumping action creates a hydrostatically balanced thrust which counteracts the natural weight of the vertical shaft. Self-cleaning is accomplished automatically when the discharge flow is throttled.

Announces Helical Gear Reducers

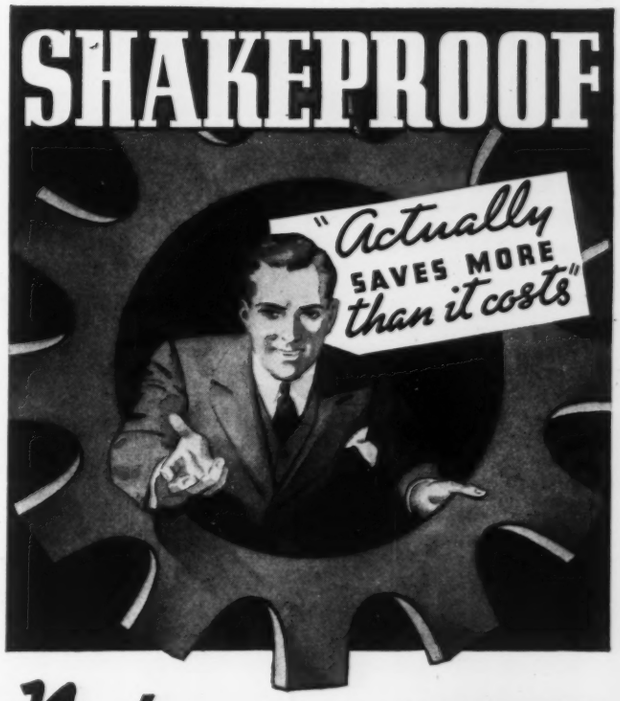
HELICAL gear reduction units, known as the Lectrigear, available in sizes ranging from 1/8 to 2 horsepower have been introduced by Ajax Flexible Coupling Co., Westfield, N. Y. Standard footless motors without change in shaft or bearings are used with the units which can be furnished either with or without the motor. It is not necessary to use a specific make of motor as there are several standard makes that fit the mounting.



Helical gear reduction units are furnished either with or without motors

Improved Cable Has Small Diameter

MAJOR improvements in the construction of its paper-insulated cable, resulting in cable of smaller overall diameter, higher dielectric strength, etc., have been announced by General Electric Co., Schenectady. These improvements include a new compact strand conductor. In addition, the change from annular to segmented construction in large single-conductor cable increases the current-carrying capacity for a given diameter. Layers of insulation are graduated, with superdense paper next to the conductor, improving the mechanical and dielectric



Performance PROVES Economy Factor

HUNDREDS of America's leading manufacturers have convinced themselves that Shakeproof's locking principle is an important means for cutting costs. Time has shown that this positive method for holding nuts and screws absolutely tight keeps customer complaints to a minimum—results in less returned goods and definitely reduces servicing and repair work. Vibration cannot harm a product that is protected with this modern lock washer for each Shakeproof twisted tooth bites into both nut and work surfaces, forming a multiple lock that won't let go. See it operate on your own product—put it up against the most severe tests you can devise. Testing samples gladly furnished on request—write today!

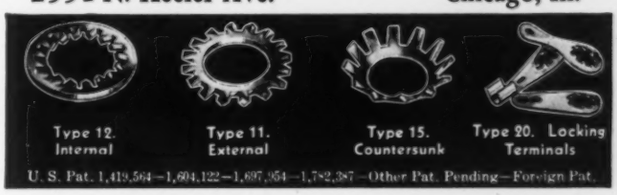
SEND FOR NEW CATALOG

Just off the press—our new 1935 catalog tells you how to solve your locking problems. Also illustrates and explains other patented Shakeproof products—a truly valuable book—send for your free copy today!

SHAKEPROOF
Lock Washer Company

Distributors of Shakeproof Products
Manufactured by Illinois Tool Works

2551 N. Keeler Ave. Chicago, Ill.



U. S. Pat. 1,419,564—1,604,122—1,697,954—1,782,387—Other Pat. Pending—Foreign Pat.

VIKING Rotary PUMPS

Are Adaptable To A Wide Range of Applications

Standard Furnished in capacities from 1/5 to 1,050 G.P.M. Electric motor, belt or gas engine drive. Widely used in petroleum, textile, soap, milk, food processing and innumerable other industries. Just "two Moving Parts." . . insures low power requirements and long life.

Hydraulic Especially designed for the actuation of machine tool movements and the operation of hydraulic lifts and elevators and all other applications requiring a hydraulic oil pressure up to 500 pounds per square inch. Capacities of 5 to 45 G.P.M.

Coolant Made of the finest laboratory tested metals in capacities of 5, 10, 15, 20 and 35 G.P.M. Built-in relief rotor to act as relief valve when the oil line is shut off. Ports are tapped and plugged to permit changing the direction of rotation.

Write for FREE Folder and Prices

Viking Pump Company
Cedar Falls, Iowa

IMPERIAL MOTORS AND GENERATORS

ARE TAILOR-MADE TO MEET THE

REQUIREMENTS OF MANUFACTURERS AND

USERS OF MOTOR-DRIVEN MACHINES.

Ratings from ½ to 300 hp. in all types.

WRITE FOR BULLETIN NO. 1020

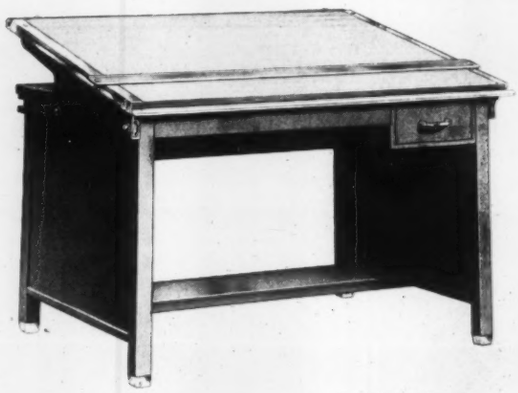
THE IMPERIAL ELECTRIC CO.
56 IRA AVENUE, AKRON, OHIO

QUALITY RIGHT PRICES
SINCE 1889
Imperial
SERVICE COURTEOUS TREATMENT

strength. On all classes of type H cable the metal shields are interlocked with paper tapes, resulting in more satisfactory shielding.

Drawing Desk Is Reversible

DESIGNED with a reversible drawing board top, a new engineering desk, shown herewith, has been introduced by Hamilton Mfg. Co., Two Rivers, Wis. Drawing board top may be tilted to various angles. The reversing arrangement makes a useful two-sided desk. When the drawing board is reversed the table may be used in multiples, with the designer or draftsman in front using the drawers and top of the desk base behind him for reference work and materials.



Reversing arrangement of board makes a useful two-sided desk in new development

Desks are made of furniture steel, the parts finished in olive green baked enamel to harmonize with other steel furniture. A variety of drawer arrangements is available. Desk height is 36 inches.

"Super-Inventing" Is Function of Patent Departments

(*Concluded from Page* 29)

and that is, refraining from receiving their disclosures in confidence (M. D. Sept., 1934, p. 60).

In the matter of the company granting license to others, this is usually taken up with the executive department to determine its policy. Frequently a condition arises where three or four companies have a large number of "so-called" improvement inventions, and no one of these companies can successfully manufacture a good device without infringing the claims of one or more patents owned by the other competitors. This works to the disadvantage of the public. To eliminate this situation it is sometimes desir-

able for the companies to work together in the matter of their patents, and all of them manufacture and sell a good commercial device. Agreements of this nature tend to stabilize prices, so that all of the companies while co-operating together make more money than they could by working against each other. Sometimes there is an exception to this policy, and that is when a pioneer company has built up a new industry and has a large percentage of the business in his particular field. In these cases, it usually is inadvisable to co-operate with new companies who may attempt to enter the field. By asserting its strong patent situation, the pioneer company can keep the competition to a minimum.

Articles on this and allied subjects by Mr. Woodling published in previous issues of MACHINE DESIGN include:

"Careful Research Obviates Patent Pitfalls," March 1933, p. 25.

"Value of Patent Depends on Efficient Claims," Aug., 1933, p. 13.

"Protect Your Right to a Valid Patent," Nov., 1933, p. 24.

"Patent Contracts Insure Legal Protection," April, 1934, p. 29.

"Patents Should Be Prepared With Care But Without Undue Delay," July, 1934, p. 24.

"Pitfalls Await the Unwary in Assigning Patents," Sept., 1934, p. 15.

"Sales Value of Appearance Can Be Protected," Nov., 1934, p. 15.

"Patent Infringement May Be Avoided by Careful Design," Jan., 1935, p. 22.

"Trademarked Machines Increase Confidence of Purchasers," March, 1935, p. 30.

Alloy Gives Hardness, Strength, Resists Corrosion

(*Concluded from Page* 32)

stress and, hence, light sections.

This combination of considerations has been the determining factor in the use of K Monel for pump rods for use on ships, which appears to be a logical application. The rods may be designed of small section, and the properties are such that the rods will endure the mechanical stress imposed upon them and at the same time resist the attack of marine corrosion.

Another successful application has been as a thin-walled cylinder subjected to high hydraulic pressure in apparatus open to mildly corrosive influence but which must function perfectly at any and all times and after long periods of idleness. This type application might be useful in safety devices and control mechanism for large power generating units or for hydraulic shock absorbers on heavy moving parts.

Success has been achieved in utilizing the material for balls to form check valves where the conditions are corrosive. One particular example is a gas heated water storage tank for domestic use, in which balls are used as a check valve in connection with thermostatic control. K Monel makes an excellent ball since it is hard, will grind accurately round and will take a high finish.

HOW MANY

——OF THESE QUESTIONS CAN YOU ANSWER?

1 What new device saves 25% to 40% of drafting time and results in far greater accuracy?

2 How can you eliminate discoloration, brittleness and bad odor from Vellum tracings?

3 Is it possible to make a pencil tracing that will reproduce approximately as well as an ink tracing—thereby eliminating the expense of ink work?

4 By what simple, inexpensive process are black line prints made directly from the tracing—without the use of a negative, and *faster* than blue prints?

5 What process is used by engineers and draftsmen when they wish to make extensive alterations on part of a tracing, *without* redrawing the entire tracing?

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PITTSBURGH LOS ANGELES SAN FRANCISCO MILWAUKEE

BEARINGS—To simplify the problem of selecting locknuts and washers for use with its bearings, Timken Roller Bearing Co., Canton, O., has prepared a series of charts listing these parts. Thirty-one different sizes of locknuts are given for use with different bearings.

BELTING—Leaflets issued by Scandinavia Belting Co., Newark, N. J., cover solid woven cotton belts for corrugating machines, and oil field drilling and pumping belts, etc. Features which adapt the belting to its particular application are outlined, and prices listed.

CONTROLS (ELECTRICAL)—A folder has been issued by Brown Instrument Co., Philadelphia, describing the advantages of its potentiometer pyrometers. This instrument, designed for recording, indicating and controlling temperatures, embodies a safety thermocouple feature that automatically shuts down the equipment, thereby preventing damage to the furnace or product in case of thermocouple failure.

DRIVES—Link-Belt Co., Philadelphia, has prepared book 1515 on its line of motorized speed reducers in which the motor is mounted directly on the side of the reducer housing. The booklet includes a table of service factors and a complete range of selection tables enabling the selection of the proper drive unit for any application. Copies of the booklet will be sent to anyone requesting them on company letterhead.

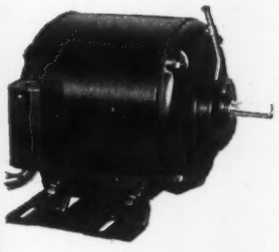
DRIVES—Ajax Flexible Coupling Co., Westfield, N. Y., has issued a folder that explains the features of its standard horizontal Lectrigear. A cross-sectional drawing shows the construction. Dimensions, ratings and prices are included.

DRIVES—An analysis of some fundamentals of industrial power transmission, including the costs of various types of installations and the effect of the type of installation on other parts needed to transmit the power properly is included in a new bulletin of Mechanical Power Engineering Associates, New York.

DRIVES—Baldwin-Duckworth Corp., Springfield, Mass., has issued pocket catalog K-1 on chains and sprockets for power transmission, conveying and elevating. A special feature is a 20-page section devoted to practical engineering data, including rules and formulas for determining chain size, length, pitch, sprocket diameter and ratios, rules for installation, alignment and operation, lubrication methods, etc. Of special value is a series of horsepower charts and tables for determining the proper chain size, etc.

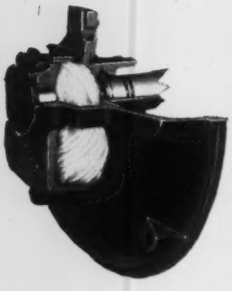
ELECTRICAL DEVICES—Catalog H recently distributed by General Radio Co., Cambridge, Mass., lists such equipment as the Edgerton stroboscope, noise meters, resistors, condensers, meters and a wide range of other electrical devices of interest to the designer.

Wagner Motors are Dependable



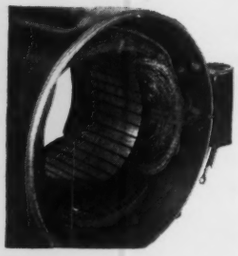
STOKERS, oil burners, blowers, fans, refrigerators, air-conditioning systems and other similar types of electrically driven equipment are kinds of apparatus where *dependability* is an essential factor for satisfactory performance.

That manufacturers have realized that a *dependable* motor has a definite bearing on the durability and performance of their equipment, is reflected in the increasing use of Wagner motors. Wagner, with forty-four years of experience in building and servicing motors, has developed a complete line of dependable motors.



Among the distinctive features contributing to the dependability of Wagner motors is the steel-backed babbitt-lined bearings with wool-yarn lubrication — steel-backed to withstand all strains to which bearings are subjected — babbitt-lined to prevent "bearing seizure." The wool-yarn is used to carry on an uninterrupted supply of filtered oil to all parts of the bearing. The upper photo shows part of bearing housing and oilwell. A portion has been cut away to reveal construction details.

Another outstanding feature is the Wagner stator — strong and rigid, yet mechanically simple. The lower photo shows a view of a stator core and frame. The frame is of rolled steel — strong, rigid, will not get out of alignment — unbreakable. Stator coils are completely insulated from frame — securely wedged in place by special tough fibrous slot insulation. Complete stator core is baked in drying ovens to drive out all moisture, then while still hot it is immersed in heavy insulating varnish, selected for its penetrating and insulating qualities, to thoroly impregnate the windings.



Dependability is but one of several qualities that manufacturers of motor-driven machinery must consider. Other considerations fully provided for in Wagner design and construction are: quietness, interchangeability, appearance and performance. For a complete description of Wagner motors, ask for Bulletin 167.

There's a Wagner motor to fit your needs, regardless of the type you prefer. Included in the Wagner line of motors are

Type RB	Split Phase
Type KA	Repulsion-Start-Induction
Type RBZ	Capacitor-Start Induction-Run
Type RZH	Capacitor-Start Capacitor-Run
Type RD	Direct-Current
Type RP	Polyphase Squirrel-Cage

Wagner Motors are available in such various mechanical variations as open, totally-enclosed, or drip-proof; rigid or resilient mounted; horizontal, vertical, or flange-mounted; sleeve or ball bearing, etc.

MOTORS
TRANS-FORMERS

Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, U.S.A.

FANS
BRAKES

S635-3D

FINISHES—A new booklet illustrating and describing the newest applications of Bonderizing as a rust preventative base for paint finishes has been made available by Parker Rust-Proof Co., Detroit. The text covers the most advanced theory of rust development, why it spreads when once started, and how it can be stopped. Also included are laboratory charts showing the progress of rust on test pieces finished in various ways, with enlarged photos graphically depicting the comparative effects of corrosion under varying conditions.

FLEXIBLE COUPLINGS—A description and a table of specifications, dimensions and list prices covering the type P flexible coupling are presented in a data sheet available from Lovejoy Tool Works, Chicago.

LUBRICATION—In a series of leaflets the Lubriplate division of Fiske Bros. Refining Co., New York, places before engineers the history and accomplishments of Lubriplate, a lubricant whose principal function is based upon its ability to react with metal to form a load carrying film on contacting surfaces of working parts. Types are listed and the wide range of application discussed.

MOTORS—Two new leaflets, one entitled "Wound Rotor Induction Motors," and the other "Type E Direct Current Motors and Generators" have been issued by Allis-Chalmers Mfg. Co., Milwaukee. Design details illustrated by photographs are covered in the descriptive text matter.

PLATES—Products produced on the world's largest plate mill and some of their uses are included in a bulletin of Lukens Steel Co., Coatesville, Pa.

PULLEYS—Magnetic pulleys built by Magnetic Mfg. Co., Milwaukee, are described in bulletin No. 300 of the company. Complete specifications have been included on sizes 12 inches diameter and larger. Copies will be sent individuals requesting them on company stationery.

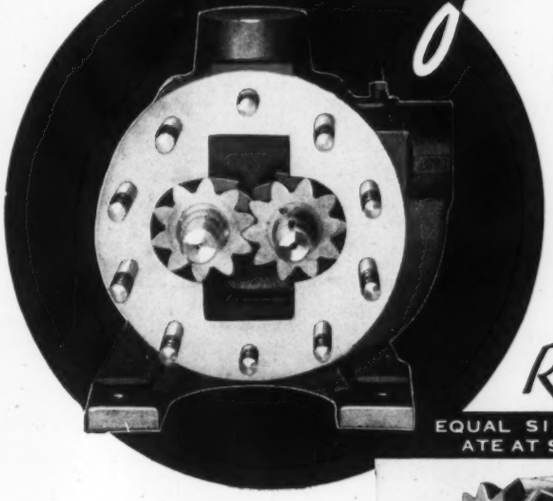
STEEL—Official SAE standard steel specifications including chemical compositions for carbon and alloy steels and an explanation of the SAE numbering system are included in a folder of Union Drawn Steel Co., Massillon, O.

STAMPINGS—"Modern Stampings—Their Place in Present Day Design, Manufacturing and Selling," is the title of an interesting booklet recently published by Geuder, Paeschke & Frey Co., Milwaukee. The contents treat the possibilities of stampings as a solution for basic sales problems involving appearance, quality and price. The progress made in this particular type of machine part also is covered in such a way as to give the reader a clearer conception of what is practical in this field.

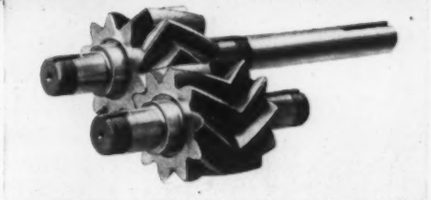
VALVES—A wide variety of valves for many applications is shown in bulletin No. 38 of Parker Appliance Co., Cleveland, which gives dimensions of the valves and drawings.

WELDER—A 16-page booklet describing the Noel "speed-arc" welder recently introduced by Ideal Electric & Mfg. Co., Mansfield, O., discusses in detail the design and operating characteristics of this unit. Photos and drawings of interest to designers considering welding supplement the text.

Why YOU should SPECIFY ROPER Rotary Pumps



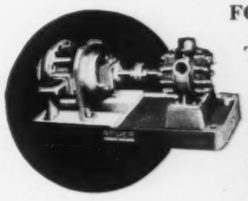
EQUAL SIZE GEARS OPERATE AT SAME SPEED



- Accurately hobbed gears keyed and pressed on to shafts.
- Extra long large bearings.
- Carefully machined case.
- Rugged cast-iron construction.

The basic design of all Roper Rotary Pumps is the simplest yet conceived . . . the result of 75 years of engineering, experimentation and experience.

Simplicity makes for efficiency, dependability and long trouble-free service as every engineer knows. Roper Pumps have earned their spurs as *Dependable* Pumps. Specify them wherever good pumps are needed.



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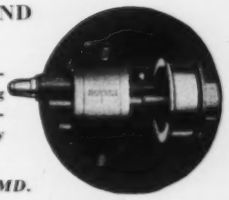
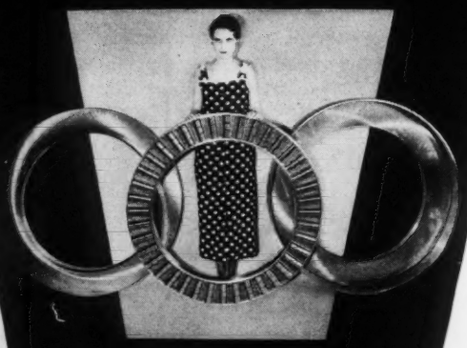


Write for Bulletin R4MD.

THE GEO. D. ROPER CORP., ROCKFORD, ILLINOIS, U. S. A.

BANTAM



Our facilities for the production of large bearings of special design are unsurpassed. Consult us on your difficult bearing problems.

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*Advertisements appear in previous issues.

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MACHINE DESIGN is a monthly technical publication conceived, edited and directed expressly for those executives and engineers responsible for the creation and improvement of machines built for sale, and for the selection of the materials and parts to be used.

BUSINESS ANNOUNCEMENTS AND SALES BRIEFS

LINK-BELT CO., Chicago, has transferred R. Y. MacIntyre, who has served as its representative in Memphis, Tenn., since 1932, to the company's district sales office and warehouse in Dallas, Tex., where he will assist E. G. Wendell, the local manager.

* * *

The Boston office of Revere Copper & Brass Inc. recently was moved from its present address at 250 Stuart street, to 138-164 Federal street, United Shoe Machinery building, Boston.

* * *

Diamond Chain & Mfg. Co., Indianapolis, recently announced the appointment of Hagerty Bros., 923 South Washington street, Peoria, Ill., as distributors of its roller chain, sprockets and flexible couplings.

* * *

A recent addition to the list of warehouse distributors of Enduro stainless steel is the Gilmore Steel & Supply Co., 825 Folsom street, San Francisco.

* * *

The New York offices of the Lukens Steel Co. have been moved to new quarters in suite 2714-15 in the Chrysler building, 405 Lexington avenue.

* * *

Cooper-Bessemer Corp., Mt. Vernon, O., and Schippers-Podevyn, Hoboken-Antwerp, Belgium, recently obtained licenses to produce all grades of Meehanite metal.

* * *

Clifford E. Broome, formerly engineer with Wm. Ganschow Co., Chicago, and more recently affiliated with Gears & Forgings Inc., Cleveland, has joined the organization of Ajax Flexible Coupling Co., Westfield, N. Y., as engineer in charge of the Lectrigear division.

* * *

Van Doren & Rideout, industrial designers with headquarters at Toledo, O., recently opened an office at 1112 Merchandise Mart, Chicago, to serve mid-west clients more effectively. Ward Adolph is in charge. The firm will continue to maintain its principal office and studios at 1217 Madison avenue, Toledo.

* * *

New York Belting & Packing Co., Passaic, N. J., announces the following changes in personnel of the company's sales organization: Harry H. Raber has been appointed assistant to the general manager with headquarters at the company's main office and factory. J. W. Webster has been transferred from the middle Atlantic states to territory comprised of Tennessee, Alabama, Florida and Georgia. His territory will be taken over by Donald F. Potter. John V. Lanahan has taken over the sales territory of Michigan, Indiana, Illinois, Iowa, southern Ohio, southern Wisconsin and eastern Missouri. Sales work in the Pacific coast states has been assigned to O. L. Wall.

* * *

E. J. Butler has been appointed to an executive position in the sales department of the Bunting Brass & Bronze Co., Toledo, O.

* * *

Announcement has been made that the New York district sales office of Republic Steel Corp. now is located in the Chrysler building. W. H. Oliver continues in charge of the office as district sales manager. Republic's export department under the direction of D. H. Bellamore, general export manager, also will occupy a portion of the new suite.

* * *

Allen-Bradley Co., Milwaukee, has announced the following new appointments: Claude O. Sargent has been added to the sales staff of the Philadelphia office. Robert McGarry, 807 Rose Place, will represent the company in Utica, N. Y., and Bjorn Hansen, 306 Canedy street, will take charge of sales in Springfield, Ill. R. B. Soderberg, 196 Palm street, joined the sales staff at the Hartford, Conn., office, and W. J. Hess, 912 First avenue, has taken over sales work at the Charleston, West Va., office.

Circulation Statement

In accordance with the Trade Practice Provisions of the Code for Periodical Publishing and Printing Industry the following constitutes "Publisher's Statement of Circulation".

This is to certify that the average circulation per issue of MACHINE DESIGN for the six months' period July 1st to and including December 31st, 1934, was as follows: Copies sold, 356. Copies distributed free, 7,770. Total 8,126. Signed—J. D. Pease, for (Publisher).

Subscribed to and sworn before me on this 22nd day of March 1935. H. L. Richey, Notary Public. My commission expires May 7, 1936.

HELP WANTED

Midwest manufacturer of hydraulic pumps and controls has opening for executive engineer; also for research engineer. Technical graduates with executive experience, preferably with machine tool or hydraulic equipment manufacturer, prefered. Send complete history with application and state salary desired.

Address Box 106 c/o Machine Design
1213 West Third Street, Cleveland, Ohio